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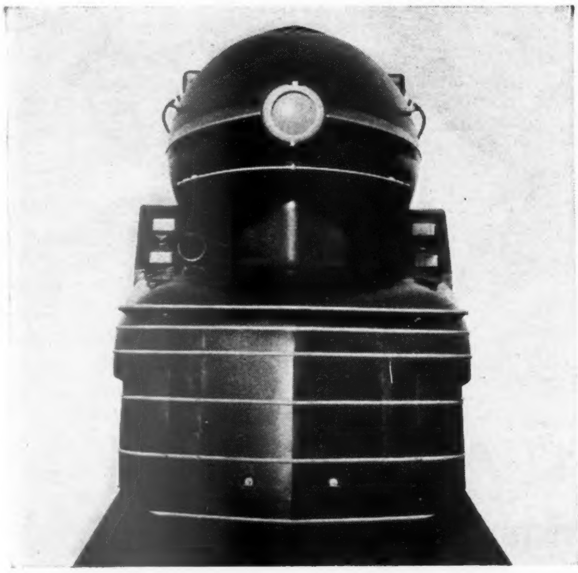

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RAILWAY
MECHANICAL ENGINEER

An Investigation of

Railway Wheel Tread Contours*

By F. H. Smith†

Adopted tread standards are compromises and not based on scientific research—A study of tread contour design—The author proposes a simple design with cylindrical tread

DURING the first 40 years of existence of the American railroad industry, most of the technical progress and development was on an individualistic basis and represented the ideas of men who were not specialists. As the industry grew into a complete continental transportation system, the transfer of passengers and freight from one carrier to another, the need for intercompany arrangements in making timetables, the interchange of equipment, and government regulation made it perhaps the most co-operative industry in existence. The success of any one road was not dependent entirely on its own local traffic, but to a very great extent on the business coming from other connecting lines.

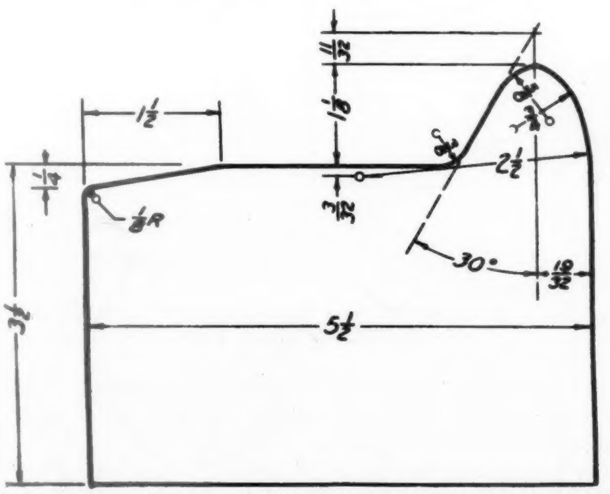

Fig. 1—Tread contour proposed, but not adopted, A. R. M. M. A., 1886

As a means of facilitating the exchange of information of mutual interest, associations were organized by railroad officials in various departments. The organization of the Master Car Builders' Association in 1867 and of the American Railway Master Mechanics Association in 1868, marked the official beginning of mechanical co-operation. One of the first and most important duties of these associations was, of course, to standardize mechanical details in order to promote economy and make equipment interchange feasible.

Tread Contour Standardization

The first indications of an attempt to standardize tread contours came in the early 1880's. At the annual convention of the A. R. M. M. A. in 1883, there was an extensive discussion on the subject of wheel treads, with particular attention given to the desirability, or undesirability, of coning or tapering the tread. At that time many held the popular belief that the tapered tread was beneficial on curves in compensating for the distance traveled around the outer rail being greater than that of the inner rail. Although this theory was considered by some railroad officers as an important factor as late as 1912, it is accepted today only by the layman who finds it as an oddity in popular reading matter. In other countries where cars are constructed with axles which assume the radial position on curves there is some advantage in coning, but the amount is questionable.

In 1884 the A. R. M. M. A. sent a questionnaire to the members asking whether they used tapered treads or straight treads and for their opinions and recommendations concerning these two designs. Twenty-eight replies were received with widely different answers and drawings submitted with the replies indicated a wide variation in the design of tread contours in service at that time. A committee was appointed to propose a standard tread, which they presented in 1886. This proposed tread, shown in Fig. 1, did not meet with sufficient approval for adoption and a decision was made to delay further action until after the M. C. B. agreed upon a standard.

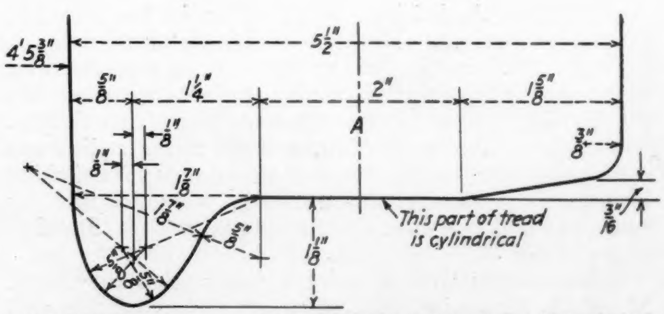

Fig. 2—Tread contour proposed in 1885 by the M. C. B.—Not adopted

At the annual convention of the M. C. B. in 1885, a

* Abstract of a thesis entitled, "An Investigation of the Design of Railway Wheel Contours" submitted to the faculty of Purdue University.
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good portion of the meeting was devoted to the subject of tread contours, with discussions on taper, throat radius, cause of sharp flanges, and cooperation with the maintenance-of-way department in fitting the tread contour to the standard rail sections. A committee proposed a standard contour, Fig. 2, which was submitted for letter ballot but failed to be adopted. In the following year, after two letter ballots had failed to adopt a standard, members were urged by the chairman to state, at the convention, their reasons for voting against the previously proposed standards. The letter ballot which followed resulted in the adoption of the first standard contour, Fig. 3. In 1887 this same tread was adopted as

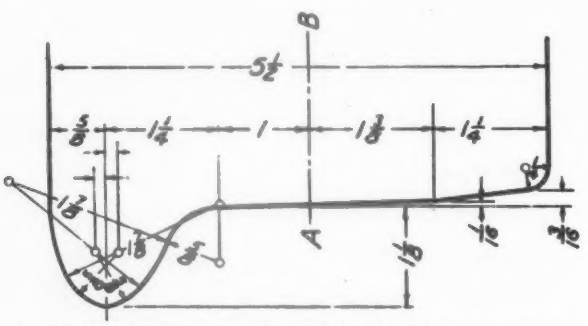


Fig. 3—Tread contour adopted in 1886 by the M. C. B., and in 1887 by the A. R. M. M. A.

standard by the A. R. M. M. A. In 1893, the A. R. M. M. A. standardized all tires with a design having the same basic contour as that previously adopted.

The next change came in 1906 when a new standard, Fig. 4, was adopted by the M. C. B. with a taper of 1 in 20 and with the throat radius increased to 11/16 in. The previous standard had a taper of 1 in 38. The

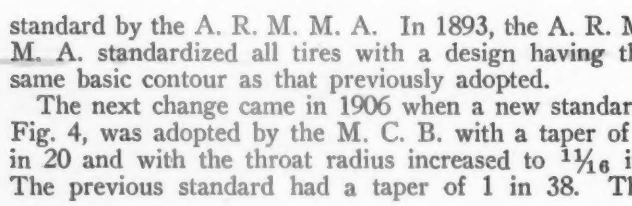


Fig. 4—Tread contour adopted for all wheels by the M. C. B. in 1906

A. R. M. M. A. followed by changing the taper to 1 in 20 but retained the old throat radius of 5/8 in.

At the 1909 meeting of the M. C. B., a representative of the wheel industries recommended increasing the throat radius as a means of minimizing sharp flanges. The effect of moving the center of the throat radius was mentioned as a possible cause of derailment of switching locomotives. New standard treads were adopted for both steel and cast-iron wheels, shown in Figs. 5 and 6, respectively.

Wheel treads were a point of interest in the A. R. M. M. A. again in 1912, when a recommendation was made, and later accepted, to reduce the widths of all tires to 5½ in. There was a lengthy discussion on the desirable height of flanges on locomotives. The values in question were 7/8 in. and 1 in. for switching, and 1 in. and 1⅛ in. for road-service locomotives. At this time many expressed a preference for cylindrical treads. Another topic discussed was the desired width of worn flanges for re-turning steel wheels. Adoption of the M. C. B. standard was recommended for tender and engine-truck wheels. In 1913, a reduction in taper was suggested as a means of reducing rail stresses which were causing difficulties for the maintenance-of-way departments. The desirability of thicker flanges on cast-iron wheels was pointed out and a check was made to see if the clearances at frogs and crossings would permit such an increase. In 1914, a new tread, Fig. 7, was adopted for steel and steel-tired wheels on engine and tender trucks, and on driving wheels in switching service.

In 1920, the American Railway Engineering Association reported to the Mechanical Division of the A. R. A., stating that frogs and crossings had sufficient clearances to pass the thicker flanges which had previously been proposed for cast-iron wheels. The Wheel Committee of the Mechanical Division met in 1923 with the A. R. E. A. in order that each might be familiar with any contemplated changes to be made by the other relative to rail sections or tread contours. The maintenance-of-way group stated at this time, that spreading rails and excessive wearing into ties and tie plates, caused by tapered treads, had been overcome by canting the rails. In this

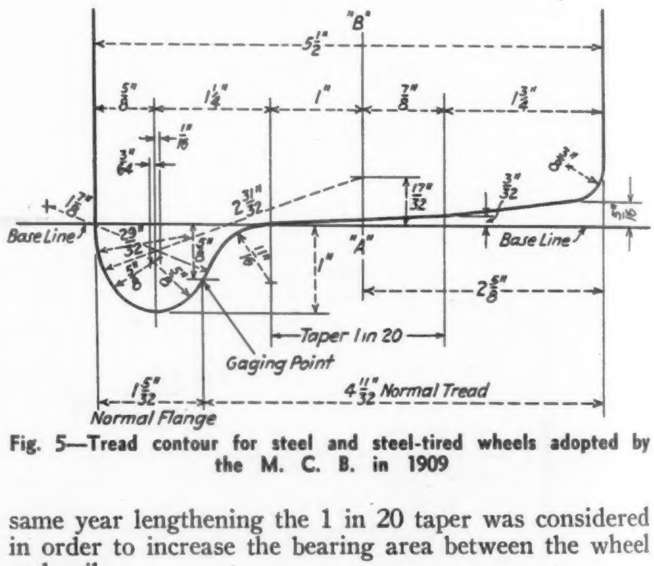


Fig. 5—Tread contour for steel and steel-tired wheels adopted by the M. C. B. in 1909

same year lengthening the 1 in 20 taper was considered in order to increase the bearing area between the wheel and rail.

In 1925, tests were started on steel-wheel tread wear, and a questionnaire was issued to determine the feasibility of using the same tread for all steel and steel-tired wheels, including driving wheels. Results of tests were

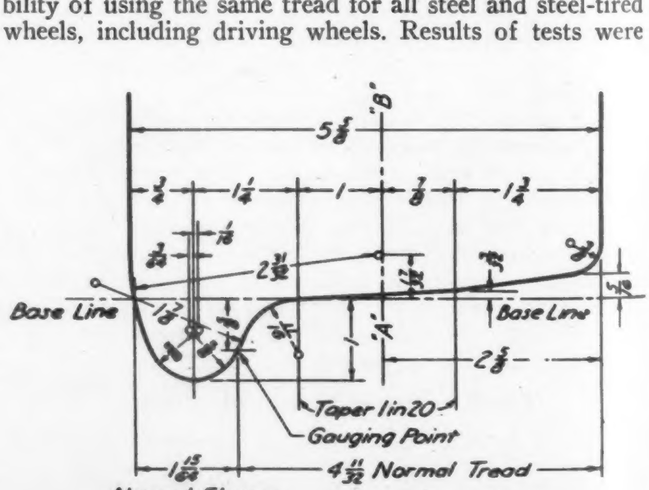


Fig. 6—Cast-iron wheel-tread contour adopted by the M. C. B. in 1909

presented in 1926, showing the comparison of wear on A. R. A. standard contours and treads with tapers of 1 in 38 and 1 in 13. No significant difference was noted

in tread wear but the flange wear was less on the wheels with the most taper as indicated in Fig. 8. Further test reports in 1927 showed that the shape of the tread had little to do with tread wear. Opinions regarding taper were voiced again in 1928 when the 1 in 13 taper was

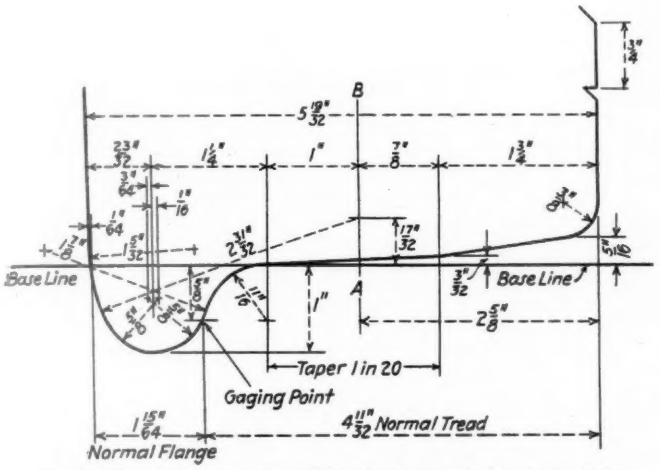


Fig. 7—Tread contour adopted by the A. R. M. M. A. in 1914

strongly favored by some, because this taper kept the flanges away from the rails. A new tread for cast-iron wheels, Fig. 9, was adopted that year.

The Locomotive Construction Committee agreed with the Wheel Committee in 1931, to use the same tread on all steel and steel-tired wheels. This decision eliminated the 1⅛-inch flanges on driving wheels. In 1932, a single straight taper was proposed to replace the double taper, but it was agreed to retain the double taper on cast-iron wheels because of a desirable relation with brake shoes. New treads were adopted in 1936, Figs. 11 and 12.

The preceding historical information was taken entirely from the proceedings of the different railway mechanical associations, and certainly does not represent all

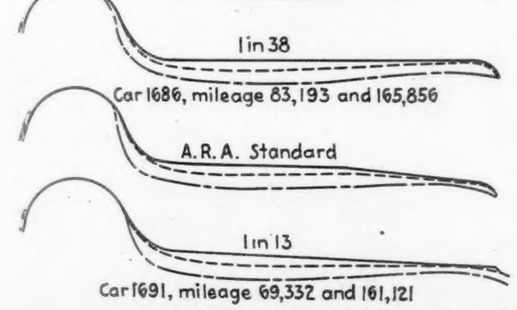


Fig. 8—Average wear of A. R. A. standard wheels compared with special contours

of the interest and work on this problem. Many of the roads have conducted tests for their own information, which were not presented at the association meetings, nor published in the railway literature. Interest in tread contours has heightened in the past decade and a number of tests are in progress at this time.

The throat radius of a tread contour is perhaps the most important part to be considered as it affects tread and rail wear, train resistance, and safety against derailment. The question in dispute is whether the throat radius should be equal to, or greater than, the radius at the top of the rail section. The first contour proposed to the A. R. M. M. A. had a ⅜-in. throat radius, and represented one school of thought at that time. The delay in the adoption of the first M. C. B. tread was caused by disagreement on throat radius as well as taper. Today the same differences of opinion exists, although the majority favor the larger radius.

When a truck with parallel axles moves around a curve it is generally understood that it tends to move on a tangent until the outer front flange strikes the outside rail. The force between the outside rail and this outer front wheel flange then diverts the truck from its tangential path by rotating the truck about its rear inner wheel. To accomplish this, the front wheels must slide laterally toward the inside of the curve; one front and one rear wheel must slide longitudinally because of the difference in length of the inner and outer rails; the rear axle naturally assumes a position radial to the curve.

It has been stated by A. M. Wellington, that the lateral force to produce the necessary sliding is constant and is not a function of the degree of curvature. The distances

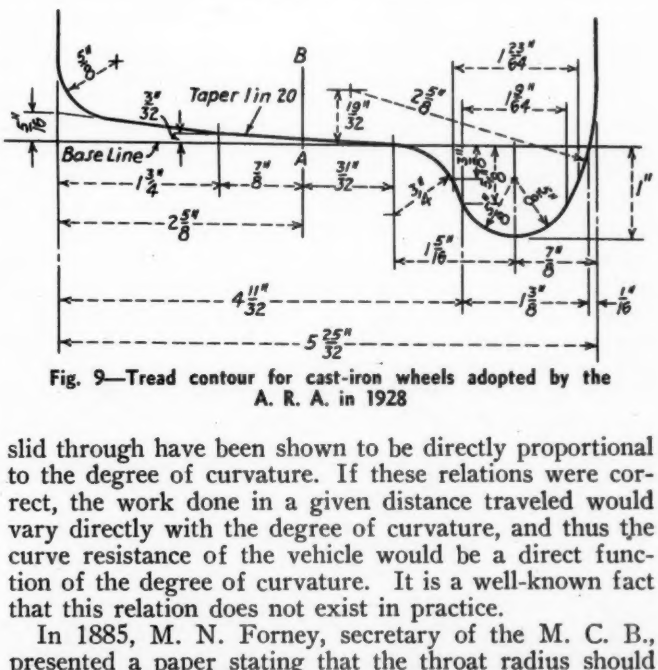


Fig. 9—Tread contour for cast-iron wheels adopted by the A. R. A. in 1928

slid through have been shown to be directly proportional to the degree of curvature. If these relations were correct, the work done in a given distance traveled would vary directly with the degree of curvature, and thus the curve resistance of the vehicle would be a direct function of the degree of curvature. It is a well-known fact that this relation does not exist in practice.

In 1885, M. N. Forney, secretary of the M. C. B., presented a paper stating that the throat radius should be the same as that of the rail section. Mr. Wellington severely criticised the suggestion with the following explanation: "Imagine a heavy sphere rolling down a plank. It has a very small bearing surface, yet any additional bearing surface which might be gained by turning the plank into a trough exactly fitting the sphere would plainly produce more friction and more wear, rather than less."

The sphere rolling down the plank is not a suitable analogy for the conditions it represents. To correct it an axis of revolution should be placed through the sphere, with one end of the axis above and in front of the normal axis. The sphere would then be partially sliding instead of freely rolling. This small amount of sliding with the high bearing pressures prevailing would cause more wear than if the sphere were rolling in the trough referred to above, where the total distance slid through

is greater but the bearing pressures very much less; particularly so if in the former case the materials are loaded beyond the elastic limit, as is often the case with wheels and rails. Tests conducted on the Philadelphia & Reading showed that decreasing the elastic limit 10 per cent by annealing rails increased the wear 31.9 per cent. Even if the wear between the ball and the perfectly fitted trough was greater than that between the ball and plank, the surfaces should adjust themselves naturally to approach the conditions of the ball and plank. The center of the trough would become a neutral line and the ball would roll on this line without excessive wear just the same as on the plank. The excessive wear on the sides of the trough would soon relieve the pressure and thus leave the ball free to roll on the center of the trough.

So far as compensation on curves for the difference in length of the inner and outer rails is concerned, there

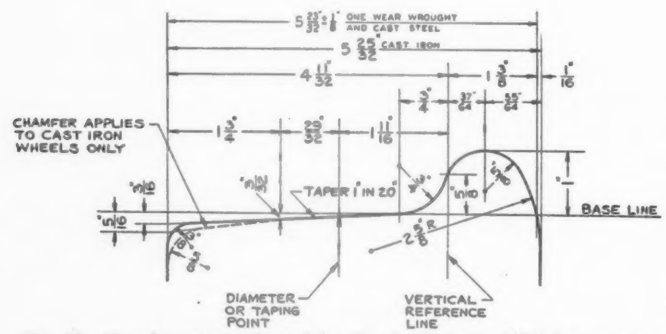


Fig. 10—Tread contour adopted by the A. A. R. in 1936 for cast-iron and one-wear wrought and cast-steel wheels

is nothing to be gained by tapered treads. The position of the outside leading wheel of a truck or locomotive is always tight against the outer rail regardless of the degree of curvature. Therefore, compensation on a front pair of wheels can be correct for a curve of only one radius. Since the rear pair of wheels either take the radial position, or tend to take that position, until the inside flange strikes the rail, any advantage in coning the front wheels would be offset by the increased sliding of the rear wheels.

The important effect of tapered treads is in the motion of a truck on straight rather than curved track. If a

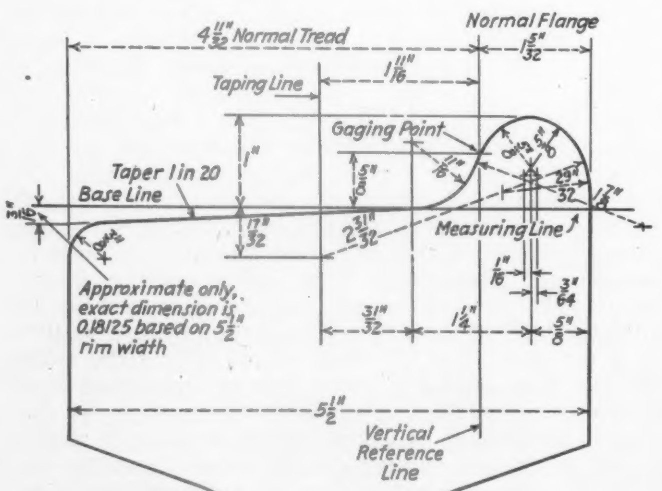


Fig. 11—Tread contour adopted in 1932 by the A. A. R. and revised in 1936 for multiple and two-wear wrought-steel wheels for cars and tenders

four-wheel vehicle with parallel axles, wheels solid on the axles, and the wheels on one side of a different diameter from those on the other side is allowed to roll freely on a plane surface its path will be an arc of a circle. The radius of this arc is not the same as that of an arc which one of the wheel pairs would describe

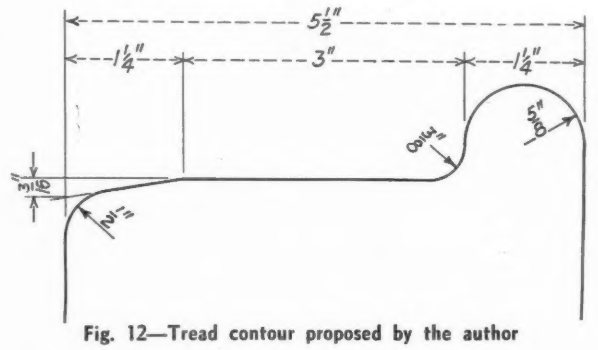


Fig. 12—Tread contour proposed by the author

in rolling singly. When a railway truck with tapered treads moves closer to one rail than to the other, the effective diameter of the wheels on this rail is increased, while on the other side it is decreased. The action described above then causes the truck to turn toward the opposite rail until it has rolled up on the larger diameter of wheels on this opposite side. This in turn causes the truck to move back again toward the other side, and thus sets up a series of lateral oscillations which might produce undesirable riding qualities in the car. Investigations in Germany many years ago, and more recently in Japan and the United States, have shown the oscillations to be in the form of sine waves with amplitudes as high as 1¼ in. on American equipment.

From the foregoing discussion it is obvious that the amount of tread taper determines both the frequency and amplitude of these oscillations. With wide wheels and sufficient taper a vehicle could be made to travel along a track, either straight or curved, without any flanges whatever on the wheels. Some railroad officers in the past have strongly advocated a taper of 1 in 13, claiming on this basis that flange pressure and flange wear would be substantially reduced by its adoption.

The lateral oscillations of trucks are not caused entirely by tapered treads. The use of cylindrical treads will produce oscillations whose amplitudes are the maximum but at a very low frequency. Even the most minute irregularity in either the track or wheel will cause a truck to move toward one rail or the other until the flange strikes that rail. The materials, being elastic, compress; the rail bends and twists; the wheel and axle bend. The work done in deforming these materials will be returned to the wheel, diverting the path toward the other rail. These statements are made with the assumption that the cylindrical wheels have been carefully paired with equal diameters. If the diameters of pairs are not very nearly the same, the truck will remain turned toward one side and cause abnormal wear.

No tests of which the author has any knowledge have shown any significant difference in wear between cylindrical treads and tapered treads. As in testing for throat wear, it is impossible to make a satisfactory road test to determine the relative wear of different tapers, because it is unreasonable, for instance, to test cylindrical treads on rails worn by wheels with a 1 in 20 taper. The results of one test of this kind are shown in Fig. 8.

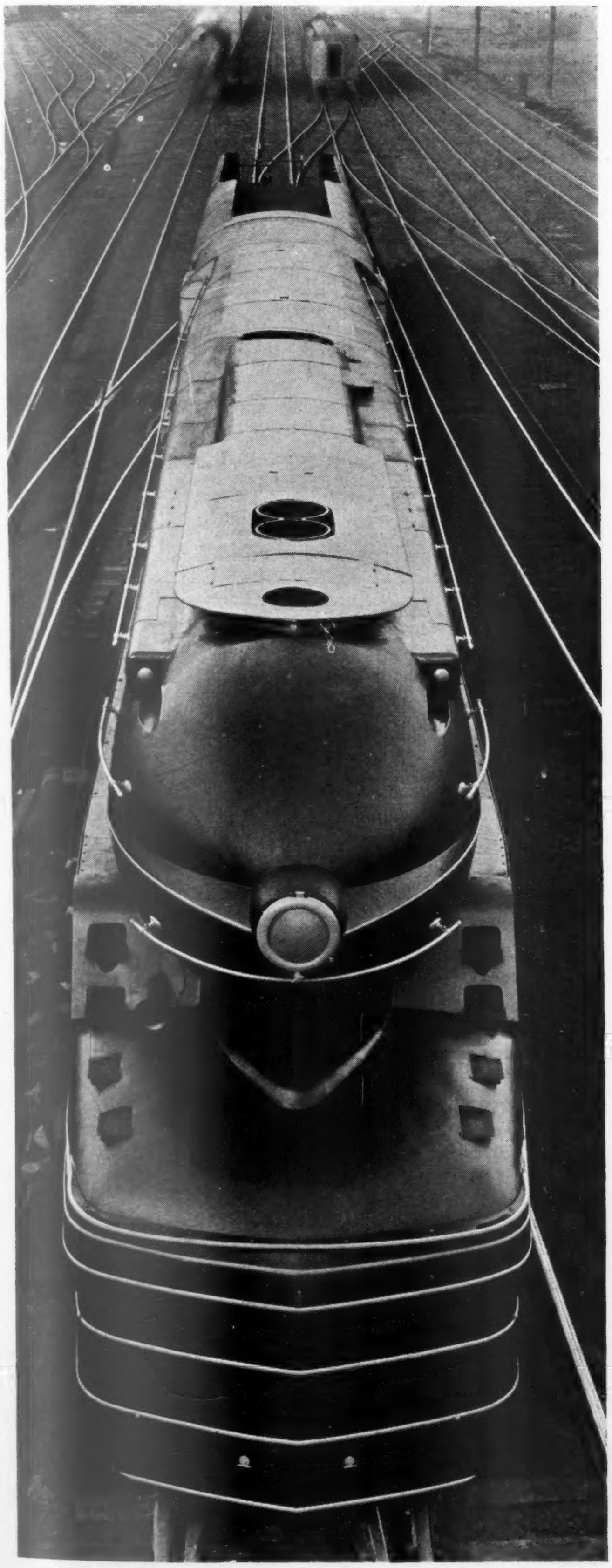
Conclusions and Recommendations

As a result of this investigation, the following con-

(*Continued on page 319*)

Unusual Details on

World's Fair Locomotive



For high-speed heavy passenger service, the locomotive built by the Pennsylvania, has two four-coupled driving units in a single bed casting—The engine weighs 608,170 lb., has a tractive-force rating of 76,400 lb., and is estimated to develop a maximum of 6,500 i.hp.

A STRIKING feature of the railway exhibit at the New York World's Fair is the locomotive of the "American Railroads" which is operating under its own steam on a demonstration stand. This locomotive has a 6-4-4-6 wheel arrangement. It was designed by engineers of the American Locomotive Company, the Baldwin Locomotive Works, and the Lima Locomotive Works, Inc., in collaboration with the Pennsylvania, and was built at the Altoona, Pa., works of that railroad. The demonstration stand is so arranged that when the driving wheels rotate, the engine-truck, trailing-truck and tender-truck wheels are also caused to rotate by the rollers on which they rest, all at approximately the same linear velocity at the trends of the tires.

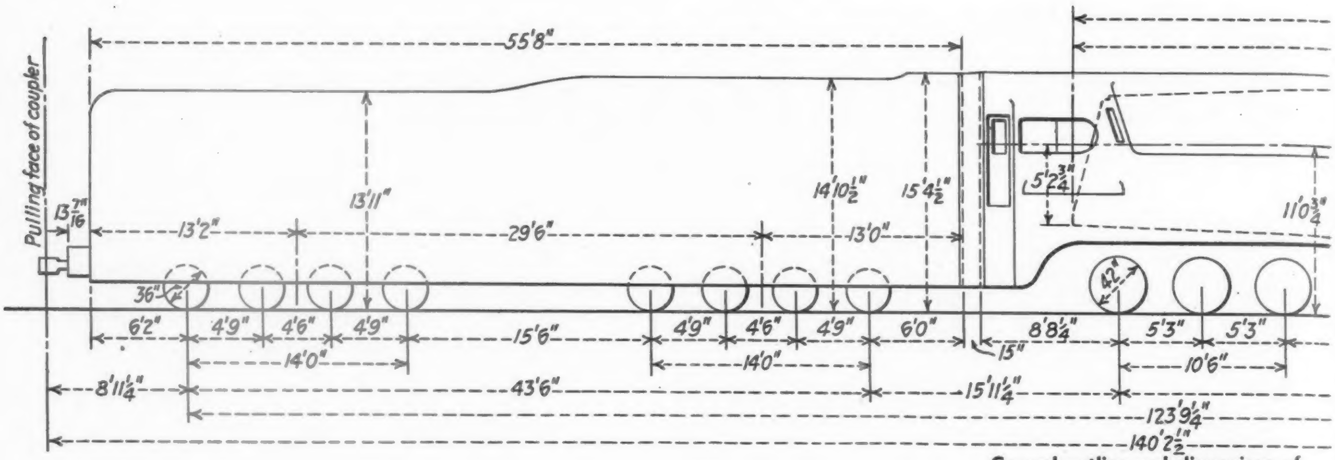
The locomotive is designed to handle heavy passenger trains of 1,200 tons at maximum speeds up to 100 m. p. h. on level tangent track. Its estimated capacity is 6,500 i. hp. As indicated by the wheel arrangement, there are two four-coupled sets of driving wheels, each driven by a pair of single-expansion cylinders, which are located ahead of their respective driving wheels, and both the engine and trailing trucks have six wheels.

Frames and Running Gear

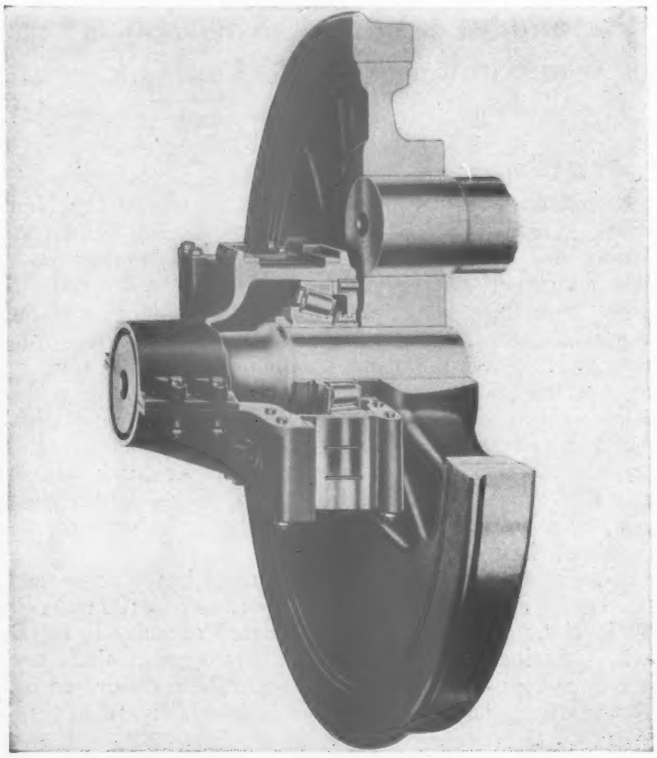
The foundation for the locomotive is a Commonwealth steel bed casting. With its two pairs of cylinders and valve chambers, including the back cylinder heads, all of which are cast integral, this bed weighs 97,620 lb., the heaviest which has yet been poured. Included in the casting is a front cylinder saddle, a forward extension from which forms the bottom of the smokebox. Pockets in the saddle portion of the casting extend down to the tops of the valve chambers and include the outside steam connection to them. In the back wall are also inside and outside flange connections for the steam pipes to the rear pair of cylinders. The cylinder spread is 92 in.

The driving wheels are of the Baldwin disc type mounted on axles with journals 12¾ in. by 13 in. The wheels are 84 in. in diameter over the tires. The journals are fitted with Timken roller bearings in split-type tubular housings. Alco lateral-motion controls are installed on the boxes of the No. 1 and No. 3 driving axles.

An unusual feature in this locomotive is the employ-



General outline and dimensions of



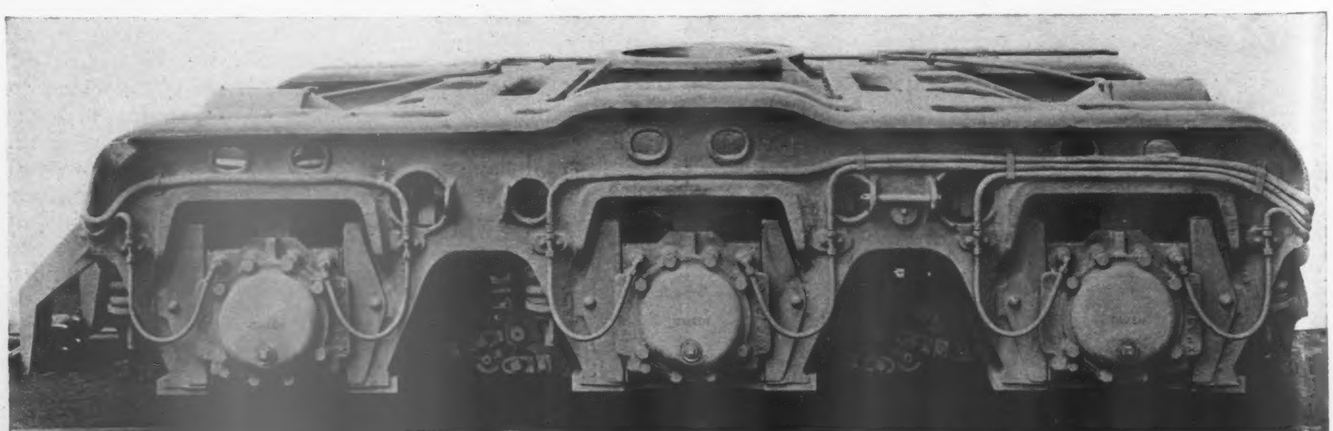
The drivers are fitted with Timken split-type tubular roller-bearing housings

ment of a stroke of only 26 in. No other high-capacity passenger locomotive has so short a stroke and to obtain it requires an offset main crank pin so that there may be sufficient metal in the wheel center between the axle and crank-pin fits. The throw of the side rod is increased by 1⅛ in. from the 13-in. throw of the back end of the main rod.

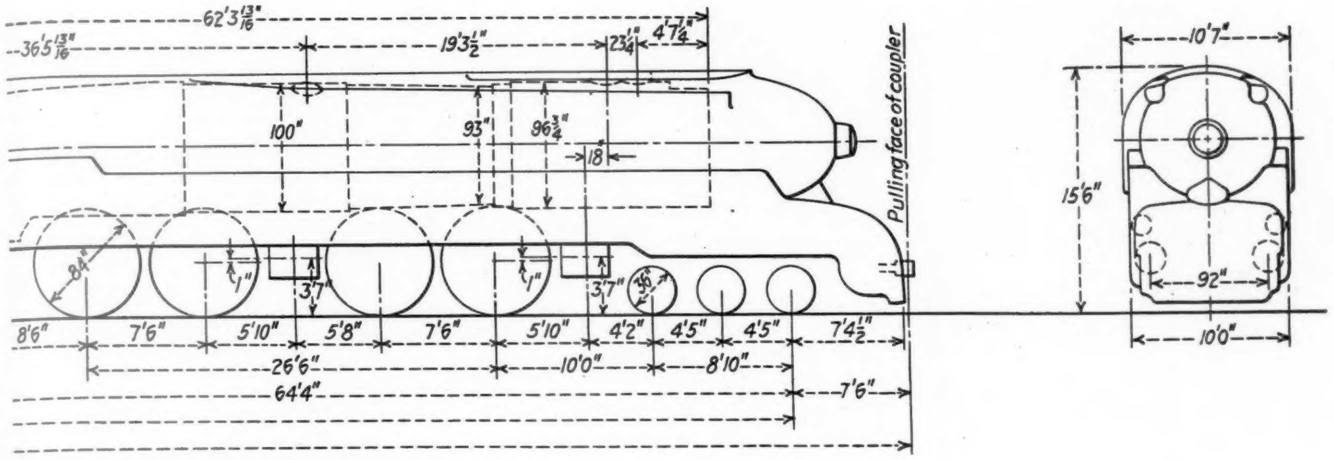
The cylinder bore is 22 in. in diameter. The piston head, piston rod and crosshead are of the Timken lightweight design employing Timken high-dynamic steel. The crosshead is the two-piece bolted type which is draw-clamped on alternate taper shoulders and recesses around the end of the piston rod. The guides are of the multi-edge type and the crosshead shoe is of aluminum alloy. The reciprocating parts on each side of each engine have a weight of 1,010 lb., 52 per cent of which is balanced.

Both ends of each side rod are fitted with spherical bushings. The convex spherical bronze bushing floats between the crank pin and the concave spherical steel bushing pressed in the rod. The main-rod crank-pin bearing is a cylindrical floating bushing.

The Commonwealth engine and trailer trucks both have six wheels. The engine truck is of the increasing-resistance geared lateral-motion type. It is unusual in that it has a three-point suspension. The leading pair of wheels are cross-equalized at the rear, while the two rear wheels on each side are equalized together. Coil springs are employed in the hangers at the front ends of the front semi-elliptical springs, at the front ends of the semi-elliptical springs over the No. 2 axle, and at the rear ends of the



The Commonwealth six-wheel engine truck has three-point suspension



the class S-1 locomotive and tender

semi-elliptical springs over the No. 3 axle. The center of the cross-equalizer at the rear of the front pair of wheels is pivoted to the truck frame.

The trailing truck is of the Delta type. The four driving wheels and the three trailing-truck wheels on each side of the locomotive are continuously equalized. Double-coil springs are inserted between the front ends of the semi-elliptical driving springs and the frame at the front ends of the No. 1 drivers and at the rear end of the trailer truck. The rear end of the locomotive is supported on the rear end of the trailer truck frame through a roller centering device.

The engine-truck journals are 7 in. by 9 in. and the trailer-truck journals 8 in. by 12 in. Both trucks are equipped with Timken roller-bearing journal boxes.

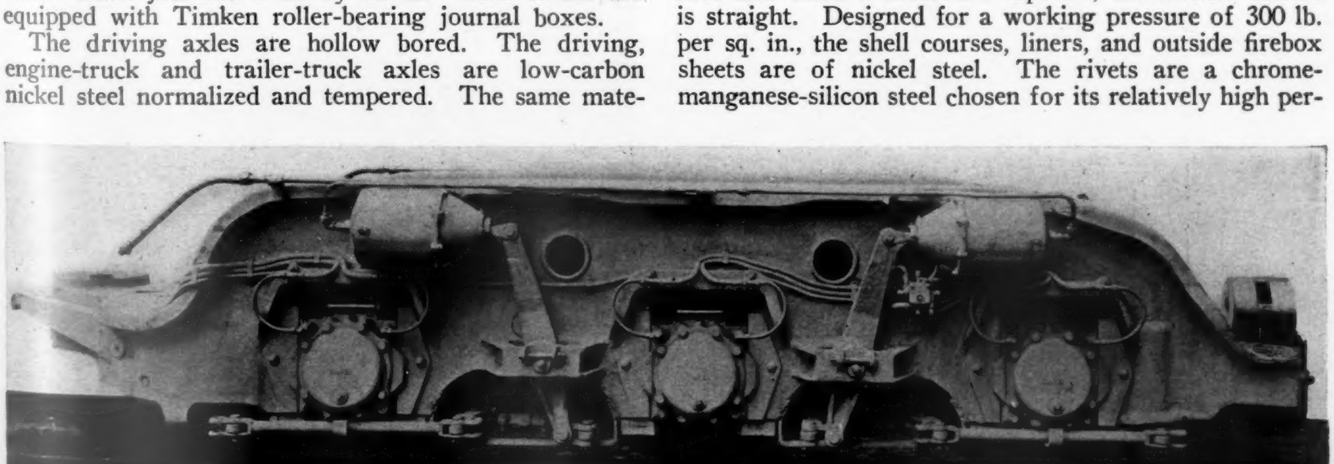
The driving axles are hollow bored. The driving, engine-truck and trailer-truck axles are low-carbon nickel steel normalized and tempered. The same material is also used in the crank pins and in the main and side rods.

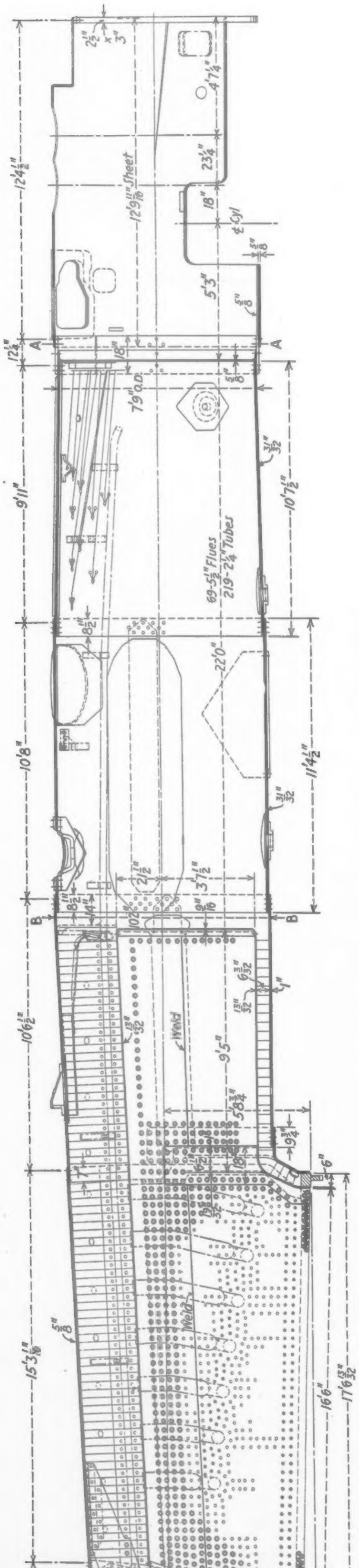
The Boiler

The boiler has 5,661 sq. ft. of evaporative heating surface and a combined heating surface of 7,746 sq. ft. It is notable for its large firebox and combustion chamber with a total radiant heating surface of 660 sq. ft. and a grate area of 132 sq. ft.

In form, it is a modified Belpaire type. The outside diameter at the first barrel course is 93 in. and at the third course immediately in front of the combustion chamber the outside diameter is 102 in. The first and third courses are tapered; the middle course is straight. Designed for a working pressure of 300 lb. per sq. in., the shell courses, liners, and outside firebox sheets are of nickel steel. The rivets are a chrome-manganese-silicon steel chosen for its relatively high per-


The Buckeye eight-wheel tender truck


The Commonwealth six-wheel trailing truck



Sectional elevation of the boiler for the S-1 class locomotive

missible bearing stresses. The front tube sheet is attached to a short connecting ring, inside of which fits the front end of the first boiler course and which, in turn, fits inside the smoke-box shell.

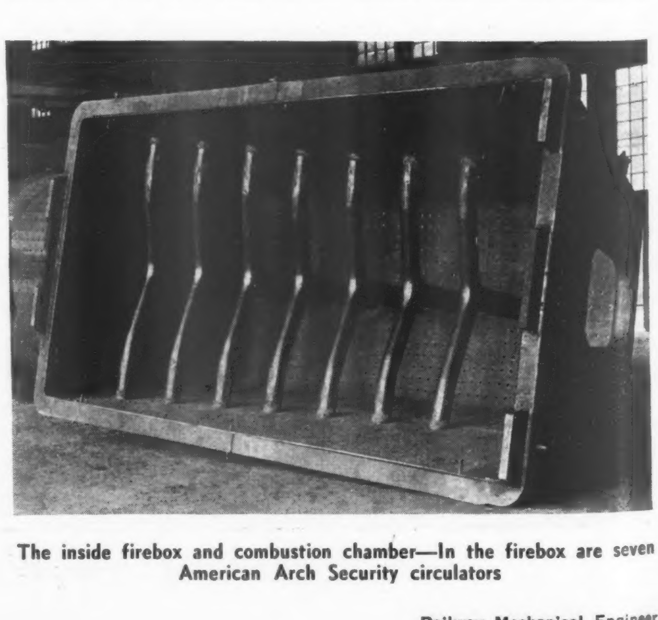
The inside firebox dimensions are 8 ft. by 16 ft. 6 in. at the mud ring, and the combustion chamber extends 10 ft. forward into the third barrel course. Immediately back of its front circumferential seam this course has been flanged to the modified Belpaire roof-sheet form. The firebox construction differs from the true Belpaire design in that the roof sheet and crown sheet cross radii are not struck from the same centers, so that the crown stays are not all of the same length.

The first two barrel courses are $^{31}/_{32}$ in. thick, and the third course and throat sheet are 1 in. Longitudinal seams are seal welded for 12 in. at the ends. The wrapper sheets are $5/8$ in., and the back-head sheet $1/2$ in. The top of the back boiler head is gusset stayed; the top of the front tube sheet is supported by rod stays.

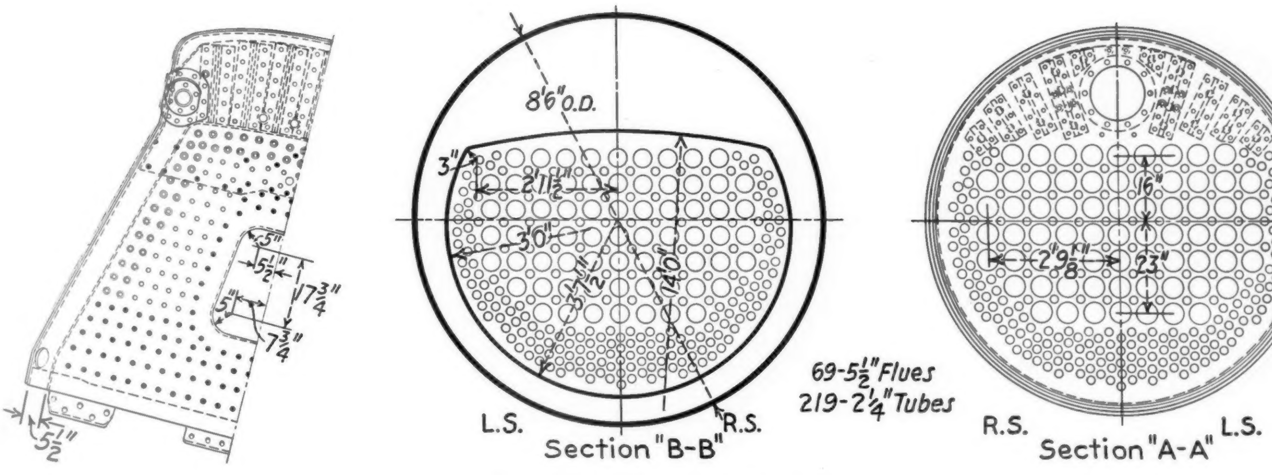
The inside firebox consists of the door sheet, the crown sheet, and two side sheets. The combustion chamber is in two pieces, and the combustion-chamber and firebox sheets are joined by a throat sheet. With the exception of the door sheet and tube sheet, all firebox and combustion chamber seams are welded. There is an extensive installation of Flannery flexible staybolts of the two-piece type with the caps welded onto the outside sheets. These include the sides and bottom of the combustion chamber, four rows along the top of the firebox side sheets, and large triangular areas at the front and back top corners. The crown stays in the four transverse rows at the front of the combustion chamber and two longitudinal rows at each side of the roof are also flexibles. Those across the front of the crown, however, have caps screwed onto sleeves which are welded to the roof sheet. Two longitudinal rows of screwed cross stays join the vertical sides of the wrapper sheets above the crown sheet.

Inside the firebox are installed seven American Arch circulators. Each consists of a $5\frac{1}{2}$-in. tube which extends across the firebox transversely and opens into the water space on either side. These tubes curve upward toward the longitudinal center line of the firebox and there merge into vertical 7-in. tubes which open into the water space at the center of the crown sheet.

There is no main dome on the boiler, the dry-pipe intake being in the form of slots along the top of the pipe inside the boiler shell. There is, however, an auxiliary dome on the left side of the center line at the front of



The inside firebox and combustion chamber—In the firebox are seven American Arch Security circulators



The back head and boiler cross-sections

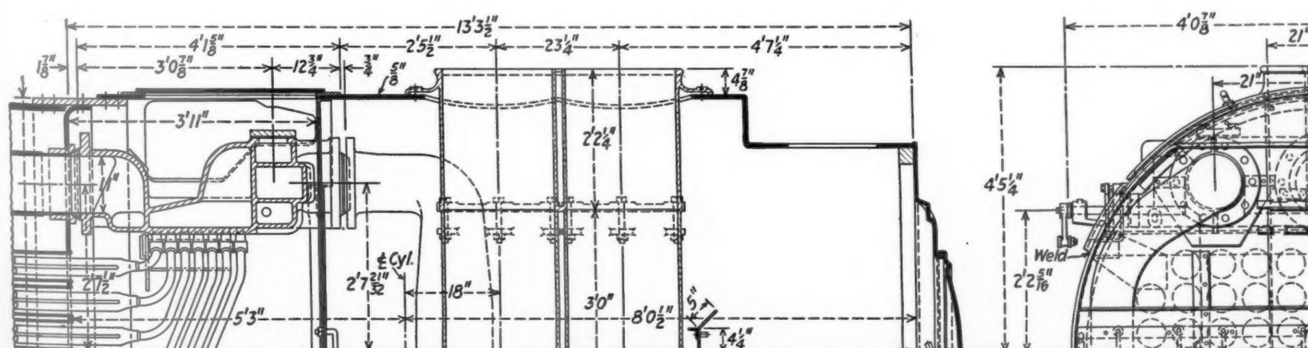
the second boiler course, with an 18 in. opening into the boiler, and a safety-valve well at the top center line near the back of the same course. This well is a heavy pressing which is mounted inside the boiler shell and depressed so that the safety valves come within the top clearance limits.

The tube sheets are laid out for a Type A superheater, with 69 double, single-pass units. The arrangement of these units is shown on the drawing of front end. The locomotive is fired by a Standard HT type stoker. The table grates are lightweight iron castings with a nickel content of 1.5 per cent and a chromium content of 0.75 per cent. The firedoor was furnished by the Standard Locomotive Equipment Company. The feedwater heater is a Worthington type 6Sa, with a type 7Sa pump. On the left side is a Sellers SW type injector. The delivery pipe for the injector extends forward from the back head inside the boiler. The boiler is fitted with mountain gage cocks, according to Pennsylvania practice for large locomotives. The intakes for these gage cocks are piped forward to a point approximately over the front end of the tube sheet. The boiler lagging is Alfol, the total weight of which is about 98 lb.

The Front End

This locomotive has an unusual front-end arrangement. There is a separate exhaust pipe and stack for each pair of cylinders. These are arranged one in front of the other, the front exhaust pipe leading from the forward pair of cylinders. Exhaust cavities below both exhaust pipes are in the bed casting. That at the front is cored to the first pair of cylinders, the center line of which is 41¼ in. at the rear of the exhaust-pipe center.

The rear exhaust cavity terminates at the face of the rear wall of the front cylinders on the center line of the locomotive. A 10-in. steel pipe leads back to the front face of the rear cylinders. A slip joint is housed within the cross member of the bed casting between No. 1 and No. 2 pairs of driving wheels. Passages from each exhaust cavity below the smokebox lead up to an opening in



The locomotive front end

The outside firebox

General Dimensions, Weights and Proportions of the Pennsylvania 6-4-4-6 Type Locomotive

Railroad	Pennsylvania
Builder	Pennsylvania
Type of locomotive	6-4-4-6
Road class	S-1
Date built	1939
Service	Passenger
Dimensions:	
Height to top of stack, ft.-in.	15–6
Height to center of boiler, ft.-in.	11– ¾
Width overall, ft.-in.	10–7
Cylinder centers, in.	92
Weights in working order, lb.:	
On drivers	281,440
On front truck	135,100
On trailing truck	191,630
Total engine	608,170
Tender	451,840
Wheel bases, ft.-in.:	
Driving	26–6
Engine, total	64–4
Engine and tender, total	123–9¼
Wheels, diameter outside tires, in.:	
Driving	84
Front truck	36
Trailing truck	42
Engine:	
Cylinders, number, diameter and stroke, in.	4–22x26
Valve gear, type	Walschaert
Valves, piston type, size, in.	12
Maximum travel, in.	7½
Steam lap, in.	1⅞
Lead, in.	⅝
Boiler:	
Type	Modified Belpaire
Steam pressure, lb. per sq. in.	300
Diameter, first ring, outside, in.	93
Diameter, largest, outside, in.	102
Firebox length, inside, in.	198
Firebox width, inside, in.	96
Height mud ring to crown sheet, back, in.	71¾
Combustion-chamber length, in.	120
Tubes, number and diameter, in.	219–2¼
Flues, number and diameter, in.	69–5½
Length over tube sheets, ft.	22–0
Fuel	Bituminous coal
Grate area, sq. ft.	132
Heating surfaces, sq. ft.:	
Firebox, total	660
Tubes and flues	5,001
Evaporative, total	5,661
Superheater	2,085
Comb. evap. and superheat	7,746
Tender:	
Type	Water bottom
Water capacity, gal.	24,230
Fuel capacity, tons	26½
Trucks	Eight-wheel
Rated tractive force, engine, 85 per cent, lb.	76,400
Weight proportions:	
Weight on drivers ÷ weight, engine, per cent	46.27
Weight on drivers ÷ tractive force	3.68
Weight of engine ÷ evap. heat. surface	107.43
Weight of engine ÷ comb. heat. surface	78.51
Boiler proportions:	
Firebox heat. surface, per cent comb. heat. surface	8.52
Tube-flue heat. surface, per cent comb. heat. surface	64.56
Superheat. surface, per cent comb. heat. surface	26.92
Firebox heat. surface ÷ grate area	5.00
Tube-flue heat. surface ÷ grate area	37.89
Superheat. surface ÷ grate area	15.79
Comb. heat. surface ÷ grate area	58.68
Evap. heat. surface ÷ grate area	42.88
Tractive force ÷ grate area	578.78
Tractive force ÷ evap. heat. surface	13.49
Tractive force ÷ comb. heat. surface	9.86
Tractive force x diam. drivers ÷ comb. heat. surface	828.5

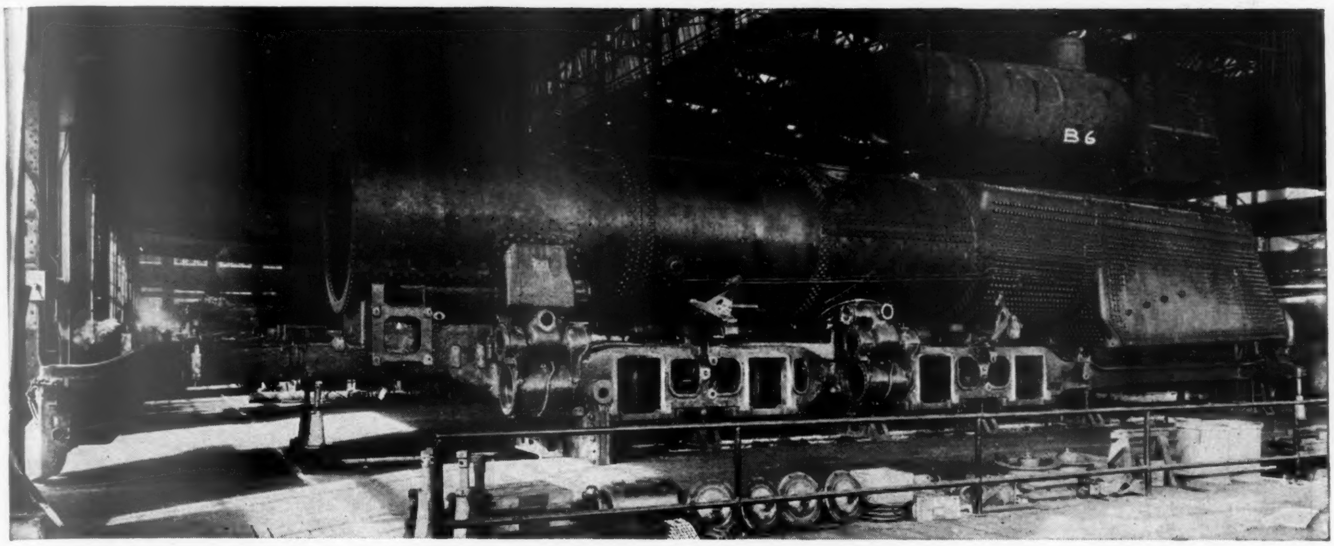
the floor of the smokebox, just inside the front-end door, from which a steam pipe leads to the feedwater heater, mounted in a recess in top of the smokebox in front of the stacks.

At the center, over the exhaust pipes, the table plate is 21 in. below the center line of the smokebox, sloping upward toward the sides. Extending down and back from the center of the smokebox door is a cinder-buster screen. Behind this screen is a completely unobstructed vertical passage of 15⅜ in. into the space surrounding the stacks. At the back of this passage is a vertical deflecting plate which extends up from the front of the horizontal table plate to a height of 4¼ in. above the center line of the smokebox. Behind this plate are the stacks, the extensions of which terminate 9 in. below the center line of the smokebox. The exhaust tips are of the annular ported type.

Steam Distribution

Steam distribution is effected by Walschaert valve gears which provide a maximum travel of 7½ in. for

The bed casting is 77 ft. 9½ in. long and weighs 97,620 lb.



An interesting comparison in boiler sizes

the 12-in. piston valves. All four valve motions are controlled by a single Alco power reverse gear. The reach rod on this gear is connected directly to the reverse shaft for the front pair of cylinders. A connection rod extends back to the reverse shaft for the rear pair of cylinders. Normalized and tempered low-carbon nickel steel is used for the radius rod, lap-and-lead lever, the link lifter and the union link. Carbon steel is used for the remaining valve-motion parts.

An American front-end throttle is built into the superheater header. The branch pipes from the header are each provided with a Y-connection at the lower end, one leg of the Y extending downward to the bottom of the cylinder-saddle pocket in the bed casting and the other extending back to the rear wall of this pocket. They are seated against the bed-casting openings with ball-joint rings. The branch pipe for each rear cylinder is in turn seated against a flanged extension on the outside wall of the cylinder saddle and extends back toward the steam-chest connection on the rear cylinder. This connection includes a slip-joint gland, and the branch pipe is connected to the front of the slip-joint flange. All connections are closed with the usual ball-joint rings. These outside branch pipes are lagged with Unarco Special Insubestos pipe covering, 2 in. thick.

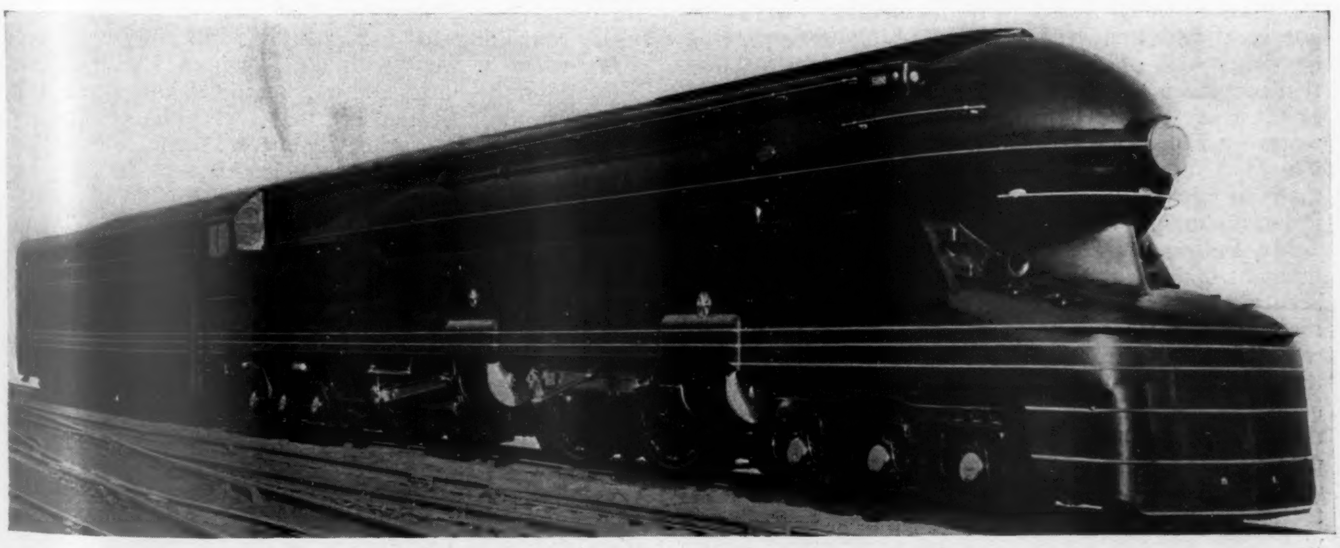
The cylinder and valve packings are Locomotive Finished Material Company lip-ring design. The piston-rod and valve-stem packings are the King type.

Lubrication

Cylinder and chassis lubrication is furnished from three Nathan DV-7 38-pint mechanical lubricators. Two of the lubricators are placed on the left side and one on the right side. Each right-side lubricator feeds one pair of cylinders and valves. There are top and bottom connections at the middle of each cylinder and a connection into the steam pipe near each valve chamber. Atomizers with steam connections from a special manifold are placed between the terminal checks and the steam-pipe and top-cylinder oil fittings. There is one oil connection to each guide. Oil lines from the front cylinder lubricators also lead to the feedwater-heater steam pipe and rear-cylinder exhaust-pipe expansion joint. Oil is fed to the stoker engine from the rear lubricator.

The lubricator on the left side of the locomotive has ten feeds, one for the pedestal shoes at each axle. Each feed line from the lubricator leads to a Nathan four-way oil distributor. From the distributor oil lines lead

(*Continued on page 319*)



The Class S-1 6-4-4-6 type locomotive, built by the Pennsylvania for heavy fast passenger service

William J. Patterson

Patterson Promoted to I.C.C.

Safety Bureau career man receives well merited recognition

WILLIAM J. PATTERSON, director of the Bureau of Safety of the Interstate Commerce Commission, was on July 20 appointed by President Roosevelt to be a member of the Interstate Commerce Commission for the term ending December 31, 1945. Mr. Patterson takes the position formerly occupied by Commissioner Balthasar H. Meyer, whose term expired December 31, last year, and who was finally released at his own request on May 1 of this year. Thomas R. Amlie, a left-wing Wisconsin Progressive, was first nominated to succeed Commissioner Meyer, but the nomination was finally withdrawn at his own request when it became evident that the Senate would not approve it.

Mr. Patterson's nomination was promptly confirmed by the Senate on July 27; he took the oath on July 31, in order to get started as a commissioner on August 1.

A practical knowledge of railroading has never been considered a necessary qualification for a place on the Commission, and very few of its members have ever possessed such knowledge. Obviously, however, a commissioner with practical railroad experience is in a position to render a real and substantial service. Much regret was expressed when President Roosevelt failed to reappoint former Commissioner Frank McManamy, who like Mr. Patterson was a career man, rising from the ranks in railroad work before entering government service, and climbing to the top.

Mr. Patterson started in as a call boy and is a former fireman, brakeman, switchman and conductor. He has been a member of the I.C.C. staff since 1914. As director of the Bureau of Safety he insisted upon strict compliance with the law, but with such tact and diplomacy that he encouraged a fine spirit of co-operation—an important factor at any time, and particularly so during the difficult economic period through which we have been passing. In the effort to cultivate better understandings and relationships Mr. Patterson frequently attended and took part in meetings of railway associations and railway clubs and has a wide personal acquaintance among railroaders of all ranks, and particularly in the mechanical and the operating departments. The new commissioner was one of five men recommended by the railway labor organizations. When in railroad service he was active in the affairs of the Order of Railway Conductors and he became an inspector of safety appliances at the invitation of Edgar E. Clark, a former president of that organization, who served on the commission from 1906 to 1921.

Mr. Patterson was born at Neenah, Wis., on June 4, 1880. In 1896 he entered railroad service as a call boy in the superintendent's office of the Wisconsin Central at Stevens Point, Wis., remaining in that position for two years. In 1898 he was employed as a brakeman on the St. Paul division of the Chicago, St. Paul, Minneapolis & Omaha. In the spring of 1899 he went to the New Mexico division of the A. T. & S. F. as a locomotive fireman, returning to the Wisconsin Central in the summer of 1899 as a brakeman and switchman. He was promoted to conductor of that road in the spring of 1902, remaining in that position until the summer of 1906, when he went with the Northern Pacific in that capacity on the Fargo and then on the Dakota and Seattle divisions, until September, 1914, when he entered the service of the Interstate Commerce Commission as an inspector of safety appliances. In August, 1918, he was promoted to assistant director of the Bureau of Safety, and on March 1, 1934, succeeded Wilfred P. Borland, who retired at that time, as director.

In speaking at the October, 1937, meeting of the New York Railroad Club Mr. Patterson pointed out that, "During the past 25 years the general trend of railway accidents has been downward, and during the past 10 years there has been a very material decline in accidents in train operation." He ascribed this improvement to "co-operative effort by railroad employees, railroad companies and government agencies." In commenting upon modernization of the services he pointed out that the continuance of the enviable safety records of the past few years should be prerequisite to the adoption of innovations in equipment or practice.

World's Fair Locomotive

(*Continued from page 317*)

to the front and back pedestal shoes on each side of the locomotive. The lubricators are driven by connections to the valve-motion links.

Alemite lubrication is used at various locations on the valve motion, crosshead guides, spring rigging, brake rigging, driving box lateral motion spring seats and throttle operating mechanism.

Brakes

The locomotive is equipped with two Westinghouse cross-compound air compressors and D-22-L air brakes with the controlled-emergency feature. This brake comprises the M-40-A automatic brake valve, S-40-B independent brake valve, D-22-E control valve and B relay valve. This is the locomotive equipment customarily employed with HSC type train brakes, except that it does not include the electro-pneumatic features. These, however, may be added in the future.

The M-40-A brake valve provides the same predetermined brake-pipe reduction in the first-service position and permits the emergency application on the second locomotive with the brake-pipe cock closed in double heading, as is available with the No. 8 ET brake. Its controlled emergency feature for operation in freight-train service is also the same as with the No. 8 ET equipment. The S-40-B independent brake valve is of the self-lapping type. With the B relay valve brake-cylinder pressure on the locomotive is maintained from the main reservoir.

Clasp brakes are applied on all wheels of the locomotive. The driving brakes are operated by one cylinder for each pair of wheels.

Cab and Cab Fittings

The auxiliary steam supply is taken from a small cast-steel fixture riveted to the roof sheet over the combustion chamber. This casting, the longitudinal section of which is triangular, has a vertical rear face from which the steam pipe leads back to the front of the cab. Steam for the blower is piped directly from the saturated-steam side of the superheater header.

The locomotive is fitted with a Union Switch & Signal continuous inductive cab signal installation.

Sand pipes are placed in front of both drivers of the front engine and in front of the back pair of drivers of the rear engine. There are four sandboxes, two on each side of the locomotive, behind the cowling below the running boards. Filling caps are accessible through the running boards. The sanders are Graham-White. In brake applications they may be operated by depressing the brake-valve handle and in emergency applications the sanders are operated automatically. There is also an independent sander valve.

In the design of the streamlining of the locomotive and tender, Raymond Loewy served as consultant. In general, the lines are similar to those first applied to a K4s locomotive, No. 3768, including the same type of smoke lifter. The cab and the bullet-nose front-end are of aluminum. Behind a removal panel in the shrouding over the pilot is mounted a folding coupler which was furnished by the McConway & Torley Company.

The Tender

The tender has a water capacity of 24,230 gallons and a coal capacity of 26½ tons. It is of welded construction, built on a Commonwealth cast-steel water-bottom underframe 58 ft. 10¼ in. long and weighing 43,060 lb.

The eight-wheel tender trucks were furnished by the Buckeye Steel Castings Co. The wheels are 36 in. in diameter and are mounted on 6½-in. by 12-in. axles, fitted with Timken roller bearings. This truck employs a modification of the type of equalized frame construction which is the feature of the Buckeye six-wheel trucks.

The clasp brakes are of the vertical-lever type and are actuated by two 14-in. by 10-in. brake cylinders mounted on each truck. Braking power is about 108 per cent of the light weight of the tender at 50 lb. per sq. in.

On the front end of the tender is a Franklin E2 type radial buffer. Barco flexible connections are used between the engine and tender. The steam-heat connection at the rear of the tender was also furnished by this company. There is a National tight-lock coupler at the rear end of the tender.

Railway Wheel Tread Contours

(*Continued from page 310*)

clusions have been reached, some of which have been based on practice and some on theory:

1—The developments of the standard treads in the past have been by ballots and not based on scientific research. The adoptions were accomplished only by compromising between widely differing opinions, all of which could not have been correct.

2—The throat radius of a tread contour should be the same as the radius of the rail section at that point. The theory upon which present practice is based is not correct.

3—Theory and practice both indicate the cylindrical tread preferable to a tapered one.

4—In order to realize fully the economies of any "correct" or "best" tread, it should be adopted and used unanimously by all roads interchanging equipment. Even then it would be several years before beneficial results are apparent.

5—So far as throat radius and taper are concerned, there should be no difference in treads of different materials such as cast iron, cast steel, rolled steel, etc.

6—The desirability and amount of chamfer on the outside of a tread is determined largely by the nature of the track over which the wheel rolls in service. On divisions where most of the track is straight a large chamfer is desirable, where on divisions made up almost entirely of curves no chamfer is necessary. Since cars in interchange move on all kinds of track, a compromising chamfer should be used on a standard tread.

7—A simple contour is proposed for all wheels in Fig. 13.

8—The problem of tread contours is of sufficient magnitude in economy and safety, that further investigation is unquestionably justifiable. The writer hopes to find it possible to continue the study in the future by the use of models.

Illinois Central Publishes "Streamline" Timetable.—Schedules, in the new timetable which is printed in a different style of type, have been reduced in size, showing only the towns at which trains make regular stops. Other stations are shown in a separate index. New maps, correctly drawn to scale, show various sections of the Illinois Central system. Other features are a brief suggestion on how to read the folder, a comprehensive table of contents, and a table of railroad and Pullman fares. On the front and back covers of each new folder will be interesting pictures of scenes in Illinois Central territory.

EDITORIALS

The Boiler-Patch Contest

In the March issue we announced a first prize of $30 and a second prize of $20 for articles describing the most interesting and difficult problems of boiler-patch fabrication or application submitted to us before May 15. In all, descriptions of twenty-eight patches were submitted. All but one or two of them presents problems which have some one or more elements of interest; several of them reflect the exercise of great ingenuity in some aspect of their design, fabrication, or application. The problem of selecting the winners from among them was a difficult one indeed.

The first prize is awarded to Fred W. Strachauer, district boiler inspector, Southern Pacific Company, Sacramento, Calif. A drawing of the patch which he submitted and a brief description of the conditions which had to be met appears elsewhere in this issue.

The second prize has been awarded to J. E. Harrison, general boiler foreman, Central of Georgia, Macon, Ga. The description of this patch will appear in an early issue. Descriptions of other patches will also be printed in subsequent issues.

Some Aspects of Smoke Prevention

"We are living in an era when conditions which were tolerated in years gone by no longer can be permitted. Not so long ago the railroads constituted the principal transportation agency and coal was, as a general rule, the only, or at least the most convenient and economical, means that could be converted into mechanical energy. We had not as yet learned to appreciate that mechanical power through the medium of steam could be created with as little smoke and dirt surrounding the operation as we have learned to appreciate it today, and for that reason we did not object to the same degree that we do today when we observed the smoke clouds, whether they came from locomotives or from stationary boilers. Today, we know that much of this smoke is not necessary and, for that reason, we should not tolerate unnecessary violations."

Thus wrote John Bjorkholm, assistant superintendent motive power, Chicago, Milwaukee, St. Paul & Pacific, in his paper presented before the meeting of the Smoke Prevention Association at Milwaukee, Wis., during June of this year.

Consciousness of the nuisance of smoke from factory and locomotive stacks goes back farther than the memory of living railroad men. Nor are organized efforts at abating the nuisance much newer. In Chicago the first smoke ordinance was passed in 1881. It lacked definition and relied on health and police departments for enforcement. Penalties were the only tools and they did not prove to be very effective. However, it soon began to be recognized that smoke abatement was not a matter of enforcing penalties, but one of education and leadership in the development of co-operation between the law-enforcing agencies and all of those having to do with the combustion of bituminous coal on grates.

Evidence of the early consciousness of the public in large cities may be seen in the electrification of the terminals within Manhattan Island and the serious consideration which was being given to similar proposals at Chicago as early as 1908. Outside of a few of the largest cities, however, the people of America have largely been content to put up with a large degree of nuisance from smoke—both that from locomotives and that from industrial chimneys as well—with occasional campaigns for its supression, because it was considered, in a large degree, as a necessary evil.

Mr. Bjorkholm points out that there are reasons for a change in this generally tolerant public attitude. There are two such reasons. The first is, as Mr. Bjorkholm points out, the fact that, so far as locomotives are concerned, it is unnecessary to produce smoke in sufficient quantities or for long enough periods at a time as to become a nuisance. The second is the constant improvement in other conditions having to do with dirt, such as paved streets and the widespread influence of modern plumbing in the promotion of increasingly fastidious standards of cleanliness.

That the steam locomotive is perhaps less generally the subject of criticism in the matter of smoke emission today than thirty years ago is striking evidence of the way in which skill in dealing with locomotive conditions, firing practice and the firing up and storing of engines at terminals has kept pace with the growing acuteness of the public consciousness of air-polluting agencies. The program, however, grows in extent as time passes. The portions of railroads outside of the larger municipalities where vigilance in the prevention of smoke can be relaxed will continue to grow shorter and shorter.

One influence which, no doubt, has effected tangible improvement in the situation at terminals is the growing use of Diesel-electric locomotives in switching service. Where such power goes into main-line service, however, it will, no doubt, have the effect of pointedly calling attention to the faults of the steam loco-

motive whenever vigilance in smoke prevention is relaxed.

As pointed out in the paper from which our opening paragraph was quoted, the equipment of the coal-burning locomotive with suitable devices for the prevention of smoke formation and supplying it with properly prepared coal are as important a part of smoke-prevention activities as education and discipline of the man in the cab.

Machine Accounting Promises Notable Economies

A revolutionary improvement in railway accounting and statistical work is now under way and seems due to be widely extended in the next few years by the installation of modern machines which will make available to locomotive-shop, car-shop and enginehouse supervisors a detailed knowledge of both labor and material costs which they never had before. Moreover this information will be furnished with such speed (within four days of the conclusion of each seven-day period) as to furnish a very definite and invaluable check on both the scope and efficiency of shop operations.

On one mid-western railroad where this mechanized accounting has been extensively installed, for example, the company has concentrated at its main office 66 high-speed automatic bookkeeping machines in a well-lighted, sound-proof, 40-ft. by 90-ft. room. Twenty-six of the machines are automatic duplicating key punches; two machines perform gang work by reproducing or duplicating automatically; four machines are used to cross check the accuracy of cards already punched; twelve machines automatically sort pre-punched cards into any desired combination at the rate of 400 cards per minute for each sorting; one machine known as the collator merges cards for the multiplier; two machines receive pre-punched cards and automatically multiply the amounts in designated columns by the amounts in other cards; four machines when connected to the tabulators automatically punch the calculating machine total into other cards.

While this sounds like a large aggregation of complicated machinery, and is just that, the method of operation is relatively simple, smooth and highly efficient. Some idea of the magnitude of the operation can be gained from the fact that in a single month the work handled on these accounting machines for the mechanical department alone amounted to 150,000 units for individual locomotive repairs; 80,000 units for shop labor distribution and 180,000 units for shop material reports. The speed and flexibility of the mechanized accounting system referred to is well indicated in the following two paragraphs quoted from a descriptive article recently published in a railway trade publication:

"This method of accounting for material while permitting greater accuracy, uniformity and speed in the entire operation at less expense and confusion, has also permitted the production of statistical reports which were not previously available and it has given great flexibility to accounting and statistical work. Price lists may now be printed on the machines from the master price cards and furnished the mechanical or other departments to keep them informed as to the cost of materials being used, simply by running the cards through the alphabetical printer. Comprehensive statements of quantities of different kinds of material consumed by the road can also be prepared.

"One of the more recent by-products is the monthly statement of locomotive repairs in which the cost of labor, the cost of material and the cost of other items of expense are given for the current month and on an accumulated basis by divisions, classes of power and by individual locomotives. Detailed reports of the cost of operating and maintaining this railroad's Diesel power are also prepared at the present time and a more efficient budgetary control of expenses at different shops has been introduced in the form of a seven-day statement showing the cost of material used at different shops—a statement which is made available within four days after the close of business in any week for any seven-day period."

With these striking results not only promised, but actually achieved in a specific case, mechanized railway accounting seems in a fair way to be rapidly and widely extended.

The Freight Conductor's Private Car

In earlier days, freight trains proceeded over single divisions of 125 to 150 miles, at the end of which the entire crew on each train was changed, the locomotive sent to the enginehouse and replaced by another locomotive with a relief engineman and fireman, and the caboose switched to a yard track, being replaced by another caboose with its conductor and brakemen.

The inefficiency of this method of train operation, particularly as regards low mileage secured from locomotives, became apparent quite a number of years ago with the result that operating divisions were consolidated, individual locomotive mileage greatly increased and attendant economies effected. If this proves to be good practice with locomotive equipment, why is it not applicable to a more general extent than is now the case with cabooses? True, the amount of investment involved is in no way comparable, but the extra delay and cost of switching cabooses to and from trains is by no means a negligible factor and appears well worth consideration in any intensive effort to reduce costs.

In a discussion of this subject by a group of practical railway officers not long ago, one of the men said "I should like to ask one question of some one in the mechanical department. I am interested in switch-engine fuel as well as other kinds. I don't know why they have built such wonderful freight cars, yet they cannot

build a way car which will run over 100 or 150 miles without having to place another one on." The reply was "The best way I can answer is by saying the one unfortunate thing on the railroad is that we have two classes of people on the division with private cars, the superintendent and the conductor; they both like to keep them." Undoubtedly, a railroad freight conductor would prefer to use the same caboose on regularly assigned runs, but it may well be questioned if this is in all cases absolutely necessary and desirable in view of the increased amount of caboose equipment required and the additional switching with associated costs which this practice entails.

Making One Job Pay for Another

Without question one of the most important factors in assuring that the service obtained from car-wheel and axle units in these days of high speeds both in passenger and freight operation is the wheel shop in which the work of preparing these parts for service is done. Several times in recent months attention has been directed to the fact that many of the wheel shops, even on the larger roads, are not all that may be desired from the standpoint of meeting the recommendations of the Wheel and Axle Manual and it has also been pointed out that in many cases it is a rather difficult matter for those who are responsible for wheel-shop operations to do the best possible job because of shortcomings in the matter of shop equipment.

Shop equipment in the wheel shop, as in most any shop doing a similar type of work, may be classified under three general groups—the machine tools, the small tools, and the parts-handling equipment. By the latter is meant the cranes, hoists, trucks and special handling devices. All three of these groups of shop equipment have a direct influence on the cost of doing work. Machine tools are expensive and, unless there is a distinct advantage from the standpoint of time and cost saving, most shop supervisors have difficulty in getting all the new machinery that they would like to have. The efficiency of performance of the small-tools group many times has a decided influence on the ability of the machine-tool group to deliver the performance which the manufacturers have built into their machines. Upon the last group—that of parts and materials handling—rests, we believe, one of the most important responsibilities of all—that of getting the part or the material to and away from the machine quickly in order that production may proceed at the most rapid, or at least at the demand rate. Without going into much detail, any shop man can make a brief operation-time analysis of the relation of machining time to handling time and will unquestionably be amazed at the small proportion of an eight-hour day that is actually taken up in machining operations on a given job. The boring of car wheels and the mounting of the wheels on the axles is a case in point. This means that unless adequate and efficient handling equipment is included in the shop inventory, it is probable that a large part of the machine and tool efficiency is discounted.

This issue includes an article describing the steps taken to eliminate some of the lost motion in one wheel shop; another appeared in the June issue. An investigation in your own shop may disclose that if more attention is paid to handling problems, enough will be saved to pay for some of the new tools that are needed.

New Books

MACHINE DESIGN. *By Stanton E. Winston, A. B., B. S., A. M., M. E. Published by the American Technical Society, Chicago. 333 pages, 5½ in. by 8½ in., illustrated. Cloth bound. Price, $5.*

"Machine Design" is described as "A text presenting those fundamentals of theory and analysis which are basic to the field of machine design," in which the author has attempted to select that material which is most basic to the field of machine design in general. The material is based on the assumption that the student has completed the subject of mechanism and that his mathematical training has extended only through trigonometry and logarithms. No resort having been made to the calculus, several rational formulas are included for which no derivations are given, but the solutions of many examples are worked out in detail in this book which is of the "how-to-do-it" type.

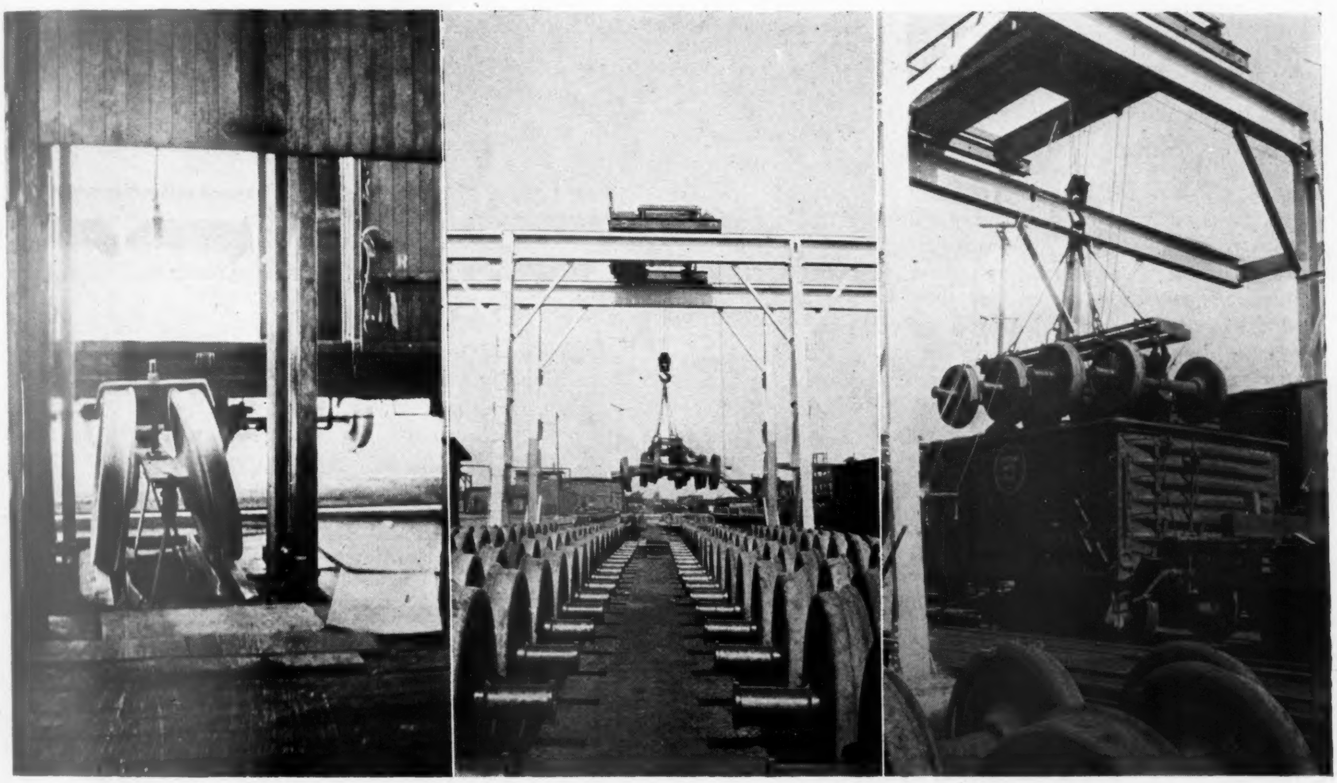
THE ENGINEERS' MANUAL. *By Ralph G. Hudson, S.B., professor of electrical engineering, in charge of the courses in general science and engineering at the Massachusetts Institute of Technology. Published by John Wiley & Sons, Inc., New York. 340 pages, 5 in. by 8 in. Price, $2.75.*

Engineering formulas, mathematical operations and tables of constants in most constant use have been consolidated in systematic order in this second edition of The Engineers' Manual, which is of pocket size. Each formula is preceded by a statement in which its application, the symbology of the involved physical quantities and definite units of measurement are indicated. The sequence of the formulas is based generally upon their order of derivation so that the understanding of a formula may be enlarged by inspection of the formulas which precede it. All catchwords, symbols and formulas are printed in bold type and each formula or group of formulas is numbered to facilitate reference to the text or cross reference between formulas. The entire chapter on Heat and a large part of the chapter on Electricity have been rewritten and brought up to date. Revisions and extensions of tables of physical constants have also been made, as well as additions in the way of new steam tables, recomputations of conversion factors affected by the latest definition of the British thermal unit, and an enlarged table of conversion factors.

With the Car Foremen and Inspectors

Missouri Pacific Reorganizes Sedalia

Wheel Shop Work



Scrap wheel elevator in loading position—Loading mounted car wheels with the Reeder device

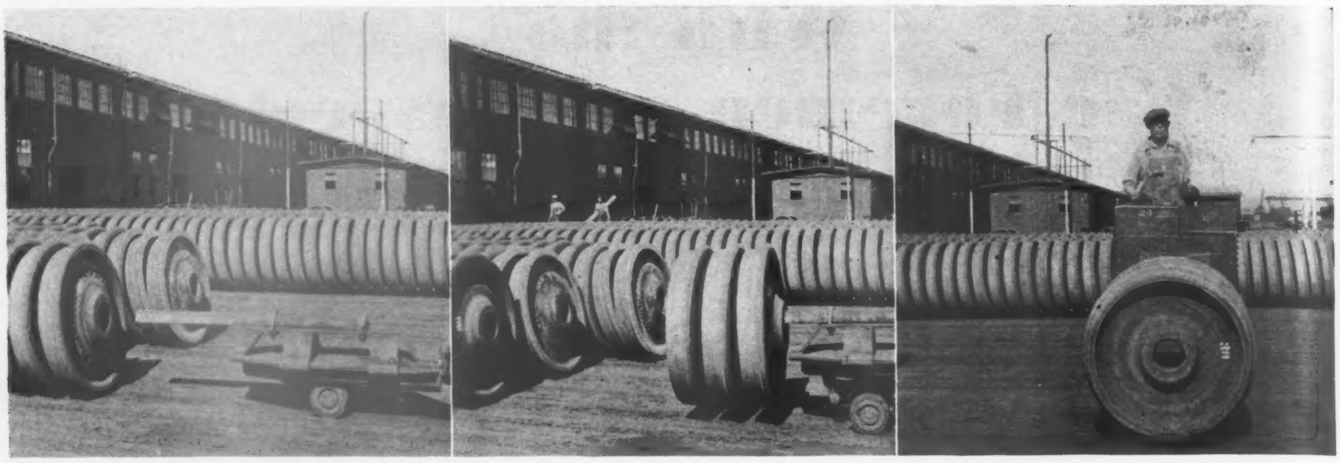
THE wheel shop at the Sedalia, Mo., shops of the Missouri Pacific has been rearranged and facilities added in order to handle all cast-iron car-wheel work for the western and a portion of the southern district of the railroad. The shop is located in the west end of the planing mill and it was desired to handle both new and old work without any interference. This is done by utilizing three doors located in the west end of the shop. The old wheels and new axles are handled along the north side of the shop moving into the center and out of the center door for distribution. The new wheels are handled along the south wall, also moving to the center and out of the center door for distribution. The above describes in a general way the routing of the work.

About 290 ft. west of the shop is a 10-ton traveling crane, operating over a track on which incoming bad-order wheels are received on flat cars and mounted wheels loaded on the same cars for shipment, also wheel tracks leading into the north and center doors of the shop and a track to the south on which new wheels are moved enroute to the shop. This track is available for handling flat cars with mounted wheels if the north track is not available.

A car of bad order wheels is received, set under the crane and six pairs of wheels unloaded at each lift by using the Reeder unloading device, illustrated, the car moved with a car spotter and another lot of six unloaded, this process being repeated until the car is unloaded. As the wheels are unloaded they are placed on a wheel track which slopes gently to the north door *A* of the shop, so that with a light push the wheels gravitate to the shop.

These wheels are inspected on the way to the shop. Just inside the door to the left is located a journal lathe, made from an old axle lathe and equipped with a Hagen end drive which revolves the axle by friction, operating at 150 to 280 r.p.m. with a $\frac{1}{32}$-in. feed. Such wheels as require journal turning are diverted to this machine where journals are turned and rolled. Those that require this operation only pass over the line of entering wheels to the center track on which they gravitate back to the traveling crane through door *B*. Such wheels as require wheels removed are placed back on the track and move onto the wheel press which is the next machine and used only for dismounting.

From this machine the scrap wheels are moved to an



Lift truck arranged for handling three wheels from the storage platform to the boring mills

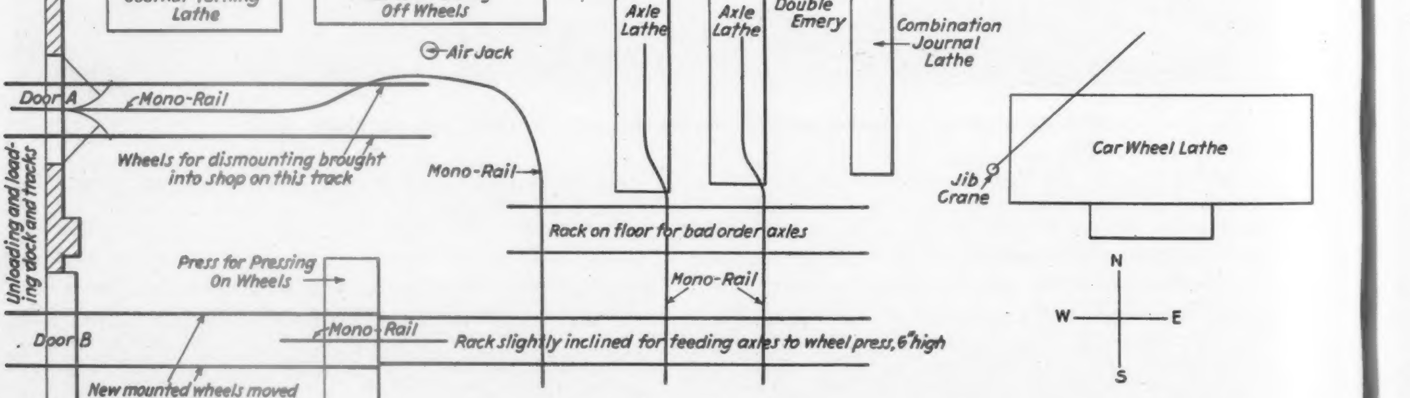
elevator located at door *D* and elevated into a box car outside. The scrap axles move on a mono-rail to a point adjacent to the loading and unloading track; the usable axles to a runway in the center of the shop in front of the mounting press, which will be referred to later.

Usable wheels, amounting to about 15 per cent of those removed, are rolled across the shop to the boring mills and from there handled the same as new wheels as described below:

Axles which require work other than journal turning, which is done on a journal lathe as the wheels enter the shop, are placed on racks adjacent to the three axle lathes which are located beyond the dismounting press. New axles are also placed on these racks, all being handled with mono-rail hoists. New and old axles after being handled on the axle lathes are placed on the runway in the center of the shop leading to the mounting press.

The finished-axle runway inclines to the back of the mounting press so that the axles roll by gravity to the press. There is a retaining device at the end of the runway arranged so one axle can be placed in position for mounting on wheels, a small air jack below the center of the axle raising it to the proper height.

New wheels, unloaded from cars just outside the door *C*, are placed on edge in rows so a small lift truck with a single projecting bar, small enough to enter the center holes, can pick up and deliver three wheels at a load. These wheels are placed on edge adjacent to a Powell pneumatic lifting device, at each of the two boring mills. These mills are located along the south wall of the shop.



Floor plan of rearranged and re-equipped car wheel shop of the Missouri Pacific at Sedalia, Mo.

Boring mill with Powell air lift—Journal lathe equipped with Hagen friction end drive

The pneumatic lift removes and loads in one lift. The top cross arm with a suitable automatic clamp picks up a wheel at each end so that a finished wheel is picked off the machine at the same time a rough-bored wheel is picked off the pneumatically operated stand at the other end. The arm is then raised, turned 180 deg. and the rough-bored wheel lowered onto the table of the machine at the same time that the finished wheel is lowered onto the pneumatic stand. The stand then lowers the finished wheel into position for rolling to the mounting press.

Both the demounting and mounting presses are equipped with pneumatic control valves which enable the operator to work from the center of the press at all times and thus eliminate the loss of operator's time for starting and stopping the ram movements. These control valves are so arranged that the press operator also handles the wheel-mounting and check gage. The wheels are then mounted on the waiting axle, journals painted with a rust-resisting solution and given a slight push which rolls them into position for loading with the traveling crane onto a car which has just been unloaded.

This describes in a general way the movement of the wheels resulting in what might be termed a double U, placed so that one outer stem represents the incoming second-hand mounted wheels and the new axles. The other outer stem is for the incoming new wheels and the center stem for the outward movement of the finished product, the two center stems coinciding.

The Reeder device, again used, requires only three lifts to load an average car. Wherever it is necessary to make right-angle movements, small air lifts are installed below the floor with suitable saddles to engage the axle centers. These jacks are used to raise the wheels off the floor enough so that they can be swung around as desired.

Formerly there were three shops in the territory handling the mounting of both steel and cast-iron wheels. The equipment from the Kansas City shop was moved and installed in the Sedalia shop described above and cast-iron wheels handled exclusively, the steel-wheel work being handled in the St. Louis shop at which point the cast-iron wheel work was also abandoned. This consolidation and concentration of work on cast-iron wheels at Sedalia and steel wheels at St. Louis has resulted in a much more economical and efficient handling of the work.

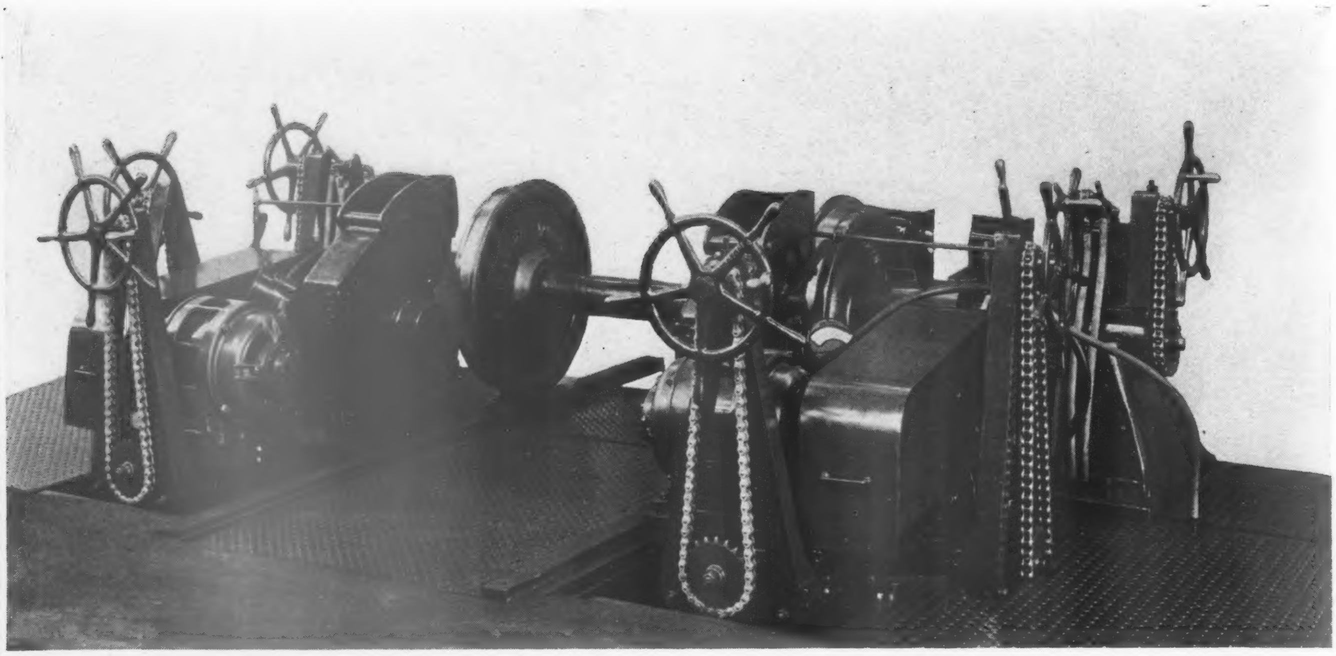
Decisions of Arbitration Cases

(The Arbitration Committee of the A. A. R. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Joint Inspection Not Necessary to Justify Bill for Flood Damage to Cars

Eighteen Missouri Pacific cars were located in the flood of January, 1937, on the Baltimore & Ohio. All of these cars were delivered to the M. P. at St. Louis without defect-card protection as required by the rules, except two cars which carried defect cards reading: "Car in flood—home for repairs." Defect cards for the other 16 cars were issued at St. Louis against the B. & O. reading: "Cars entirely submerged in flood waters," or "Cars in flood waters to a certain height," and "Home for repairs." The defect cards did not show any specific items of damage to the cars. Bills were rendered to the B. & O. covering the cost of repairs due to the flood damage. The B. & O. contended that a blanket defect card should not be authority for the car owner to render bill for extensive repairs without obtaining joint inspection certificate in accordance with Rule 4, Section (k), or giving the carding line an opportunity to inspect the cars. The M. P. contended that flood damage is a handling-line responsibility as defined in Rule 32, Section (1), and

(Continued on page 329)



Operator's side of the new A. C. F. car wheel grinding machine

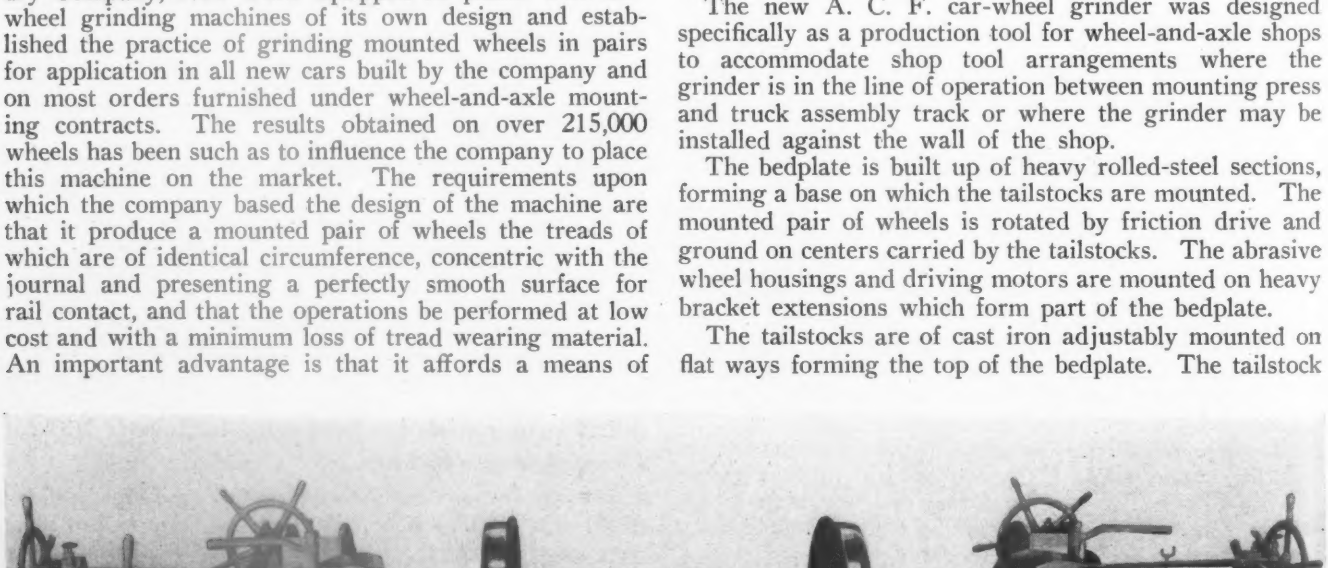
Wheel Grinder Operates On New Principle

About three years ago, the American Car and Foundry Company, New York equipped its plants with car-wheel grinding machines of its own design and established the practice of grinding mounted wheels in pairs for application in all new cars built by the company and on most orders furnished under wheel-and-axle mounting contracts. The results obtained on over 215,000 wheels has been such as to influence the company to place this machine on the market. The requirements upon which the company based the design of the machine are that it produce a mounted pair of wheels the treads of which are of identical circumference, concentric with the journal and presenting a perfectly smooth surface for rail contact, and that the operations be performed at low cost and with a minimum loss of tread wearing material. An important advantage is that it affords a means of checking the preceding fabricating operations such as molding, boring, mating and mounting. Imperfect work is immediately reflected as soon as the mounted wheels are revolved in the grinder and contact made by the abrasive wheels.

The new A. C. F. car-wheel grinder was designed specifically as a production tool for wheel-and-axle shops to accommodate shop tool arrangements where the grinder is in the line of operation between mounting press and truck assembly track or where the grinder may be installed against the wall of the shop.

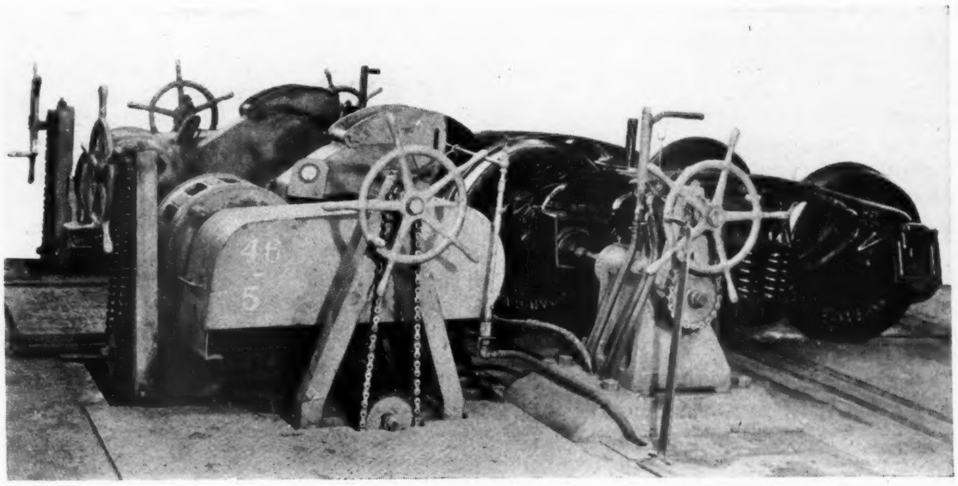
The bedplate is built up of heavy rolled-steel sections, forming a base on which the tailstocks are mounted. The mounted pair of wheels is rotated by friction drive and ground on centers carried by the tailstocks. The abrasive wheel housings and driving motors are mounted on heavy bracket extensions which form part of the bedplate.

The tailstocks are of cast iron adjustably mounted on flat ways forming the top of the bedplate. The tailstock



The rear of the machine showing the pneumatic-tired drivers in the floor

A side view of the grinder with a freight car truck mounted in the machine for the grinding of one pair of wheels



spindles are of large size, are rotatable and secured in any angular position by means of clamp bolts. The centers are eccentrically located in the spindle, the throw determining the distance from the friction drive wheel to the center of the spindle, thus accommodating a range of car-wheel diameters from 28 in. to 37 in.

A friction drive is employed for rotating the pair of mounted wheels when being ground, which consists of two pneumatic-tired wheels making driving contact with the treads of the car wheels being ground. This work drive consists of a longitudinal shaft located in the bedplate below the tailstocks and parallel with the tailstock centers. On this shaft are mounted the two pneumatic rubber-tired wheels. This shaft is driven by a geared motor directly connected to one end of the shaft. The rubber-tired wheels are elevated into driving position or lowered when work is being rolled in or out by means of a small air cylinder adjacent to each wheel. The use of this type of drive permits grinding the treads of mounted wheel pairs without the removal of roller-bearing journal boxes.

Two independent driving heads for abrasive wheels are adjustably mounted on the bracket extensions of the bedplate. The driving heads are mounted on the bedplate with the abrasive wheel spindles parallel to the taper treads of the car wheels and each abrasive wheel is fed against the work by means of a hand-operated feed screw. Each abrasive wheel is mounted on a roller-bearing spindle and is rotated by means of a multiple V-belt drive from a motor secured on top of the cross-slide table. Adjustment is provided for the angle of the face of the abrasive wheel to enable the operator to grind wheels with either cylindrical or taper treads.

The bracket extensions to the bedplate have ways planed on top parallel with the bedplate, on which a large table is fitted. In the top of this table ways are planed at right angles to the abrasive wheel spindle and a second table or cross-slide is fitted thereon. The abrasive wheel and motor assembly is bolted on the cross-slide and may be fed against the work or backed off by means of a hand-operated feed-screw. Provision is also made for manual feed of the abrasive wheel across the face of the work. The entire abrasive wheel and motor-drive assemblies are retractable from the working position away from the transverse center line of the machine; movement parallel with the center line of the bed from the operating position to a position toward the ends of the machine is effected by means of air cylinders the piston rods of which are directly connected to the table above described.

The characteristic of retractable grinding heads, permitting the rolling of mounted pairs of wheels through the grinder on the running track in a continuous direction is unique in this machine and has proved practical. It also permits grinding wheels without removing them from freight trucks.

The A. C. F. grinder is designed for alternating-current motor equipment but modifications can be made for direct current if desired. The motor equipment of the standard machine consists of two 25-hp., three-phase, 60-cycle 220/440-volt motors on the abrasive-wheel drive, operating at 1,800 r. p. m. and one 4-hp. general purpose enclosed-gear motor which operates at 37.5 r. p. m. This latter motor is on the work drive.

The A. C. F. grinder occupies floor space 10 ft. by 24 ft. and weighs 24,000 lb. in working order. Two 30-in. by 2½-in. by 12-in. abrasive wheels are furnished as standard equipment. The machine is designed to grind the treads of wheels mounted to 4-ft. 8½-in. gage but can be built for narrow-gage work.

Experience with this machine has indicated that the average floor-to-floor grinding time for new chilled-tread wheels is from 3 to 4 min.; two men are required to perform the grinding operations.

The advantages claimed for ground wheel pairs of identical circumferences, and having perfectly smooth treads, concentric with the journals, are: reduction in required tractive force; increase in wheel mileage; elimination of noise; reduction in vibration with resultant lowering of maintenance cost of truck and brake parts and reduction in losses due to breakage of fragile lading.

Draft Gear Maintenance And Claim Prevention*

As is the case with all parts of the cars, draft gears become defective from breakage or from excessive wear, and because the efficiency of the draft gears is dependent upon their proper maintenance, it is very important to have a definite program for maintenance.

In 1927, the Chicago, Milwaukee, St. Paul & Pacific inaugurated a program for periodical inspection of draft gears and repairs if necessary. Because all freight cars

* Abstract of a paper presented by F. A. Shoulty, assistant superintendent car department, Chicago, Milwaukee, St. Paul & Pacific, at the forty-seventh annual meeting of the A. A. R. Freight Claim Division, held May 23 to 25, inclusive, at St. Louis, Mo.

must have the journal boxes repacked and air brakes cleaned, oiled and tested, and cars reweighed and restencilled periodically, under the Association of American Railroads Rules of Interchange, it was deemed an opportune time to examine the draft gears and couplers as well, therefore a definite program was adopted and put into practice whereby draft gears and couplers are minutely examined under certain definite instructions covering system cars.

The coupler is pulled forward as far as possible and pushed back again, this process being repeated several times so that the repair man, who is a specialist on draft-gear repairs, may note whether the draft gear is in need of renewal of some part. If there are no indications that the gear requires repairs, the gear is not taken down, but if there are indications that the gear requires repairs, it is removed from the car and given necessary repairs and renewal of parts. The car is then stencilled, just above the coupler, to show that the draft gear has been inspected and the date and station at which inspection was made is also shown. A record of the test is made and a copy of such record for each car is forwarded to the office of the superintendent of car department, where it is recorded and filed. I might add that whenever a car is shopped for general repairs, which on the Milwaukee is approximately every four years, the draft gears must be removed from the car despite their appearance from outward inspection. The gears are then examined minutely and repaired or replaced.

At the time that draft gears are inspected, both periodically and at the time of general repairs of the car, loose or broken coupler-pocket rivets and cracked and excessively worn coupler pockets are repaired or replaced. Particular attention is given to the back filler in riveted yokes, and where found to be loose or missing, they are replaced. The riveting of the filler in the yoke is not permitted unless the hole is properly countersunk. Coupler keys having the old hairpin cotters are removed, a new hole is drilled and a T-head pin is applied.

Excessive slack in draft gears is corrected at the time of draft-gear inspection. Excessive slack may be determined by drawing the coupler forward and sledging it solid so as to remove all movement of the draft gear. When this is done, if the distance between coupler horn and striking casting exceeds 4½ in., necessary renewal of parts must be made so that this distance be as close to 3 in. as is possible but not exceeding 4 in.

While draft gears and couplers with component parts have been improved a great deal in the past, much still remains in the way of further improvement. Next to wheels, draft gears and couplers are the greatest source of expense in car maintenance and no effort should be spared to improve these parts.

Defective Gears Reduced from 15.6 to 4.6 Per Cent

When we started our periodic inspection of draft gears in 1927, 15.6 per cent of the gears were found to be defective to the point where certain parts had to be renewed. During the year 1938, only 4.6 per cent of the gears inspected were found defective to such extent. In 1928 we spent $338,000 for couplers and coupler parts, while in 1938 we spent only $96,000 for couplers and coupler parts. It must be considered that these savings were accomplished despite the fact that the gears are attached to steel sills which provide no elements for absorption of any of the shocks as was present in the old wooden sills. It is, therefore, obvious that the reduction in defective draft gears and the reduction in failures of couplers and their parts has been due to the greater efficiency of the cushioning effect of the maintained draft gears, and this greater cushioning effect must necessarily have some effect in reducing damage to lading. We do know that our freight-damage bill has been considerably reduced during the past 11 years, but just what portion of this reduction is directly attributable to better-maintained draft gears is not obtainable from the records.

It would be very helpful to individual railroads if the A. A. R. would classify draft gears according to the results obtained in official tests. A good many do not consider that 25,000,000 ft. lb. is sufficient to determine the life and merits of a draft gear. This limit may be satisfactory as a minimum but it is a known fact that some draft gears will stand several times more than the 25,000,000 ft. lb. requirement, while other draft gears which just come within the requirement, will be certified as meeting A. A. R. requirements. If draft gears could be purchased on the basis of quality instead of uniform price, considerable headway could be made.

Notwithstanding the fact that we have gone through practically ten years of depression, the Milwaukee has continued its draft-gear inspection program and demonstrated that it has proved profitable, from an economic standpoint, not to curtail the maintenance budget to the extent of sacrificing draft-gear inspection, when economies must be enforced. If all railroads were as conscientious about draft-gear maintenance as they are about cleaning air brakes, repacking journal boxes and reweighing cars, it is my opinion that freight claims would be very substantially reduced, as free-slack in a freight train probably is doing more damage to lading than anything else.

Air Brake Questions and Answers

D-22-A Passenger Control Valve (Continued)

472—*Q.—Name the operating positions of the D-22 valve.* A.—The release, preliminary quick service, service, service lap, graduated release lap, emergency, and accelerated emergency release.

473—*Q.—What communications are open in the release position?* A.—Between the brake pipe and the auxiliary reservoir as follows: Brake pipe to face of the service piston, through the feed groove in the service piston bushing to the service slide valve chamber, to release the piston chamber, and from there through passage to the auxiliary reservoir.

Between the brake pipe and the emergency reservoir as follows: Through the charging port *X*, in the service piston bushing past the ball check valve *85* and the flat check valve *73*, through choke *81*, and through passage *2d* and pipe *2*, to the emergency reservoir. [Note—Letters and figures refer to instruction pamphlet diagrams—Editor]

Between the brake pipe and the supply reservoir as follows: Through passage *s* and choke *83* to limiting valve chamber *H*, past check valve *147* to passages past the ball check valve *85a*, and flat check valve *73a*, to the chamber above check valve *74* and *87*, thence through passages and pipe *6* to the supply reservoir.

Between the brake pipe and chamber *F* on release insuring diaphragm. Between the brake pipe in chamber *B* on the face of the emergency piston and the quick-action chamber via charging choke *27* to chamber *E* on the slide valve side of the piston and a passage.

Between the service slide valve chamber, auxiliary reservoir pressure, and the release slide valve chamber.

Between the service slide valve chamber and the spring

side of the release piston (chamber E) by way of the port in the service slide valve and passage in its seat.

Between the auxiliary reservoir and the supply reservoir as follows: From chamber D through the port in the release valve and the passage in its seat past ball check *74* and flat check valve *87* to the passage leading to pipe *6*, to the supply reservoir.

Between the displacement reservoir and exhaust by way of the cavity in the release slide valve and the exhaust passage in its seat.

Between the emergency reservoir to the under side of the emergency slide valve and between the emergency reservoir and the small diaphragm area on the upper side of the cover gasket exerting downward pressure through the strut to keep the emergency slide valve seated when there is no pressure above the slide valve.

Between the emergency reservoir and the spring chamber above the spill over check valve.

Between the emergency reservoir and both the outer face and the spring side of the emergency valve.

Between the under side of the ball check *51* (through a choke passage) and emergency slide valve chamber E and the quick action chamber.

474—*Q.—What communications are open in the preliminary quick-service position?* A.—The brake pipe to atmosphere by way of the service graduating and slide valve and communicating ports and passages past the limiting valve to the quick service volume which is permanently connected to the atmosphere.

From the spring side of the release piston to atmosphere (auxiliary reservoir pressure) by way of ports and cavity in the service slide valve to the exhaust port (exhaust).

From the displacement reservoir by way of passages and cavity in the emergency slide valve to the safety valve, and to the face of the emergency valve.

From the quick action chamber by way of a vent port in the graduating valve and the exhaust port in the slide valve to atmosphere.

From the emergency reservoir to the chamber above the spill-over check valve, emergency slide valve strut diaphragm and under the side of the emergency slide valve.

From the emergency reservoir to the under side of the service slide valve, the chamber over the emergency reservoir check, the spring side of the emergency valve, and the chamber over the emergency reservoir charging check valve.

From the brake pipe to the vent valve chamber, the chamber over the accelerated release check, chamber F in release insuring valve portion, chamber H in quick service limiting valve portion, to displacement reservoir.

From the auxiliary reservoir to the auxiliary reservoir check valve and to release insuring valve portion.

475—*Q.—What communications are open in the service position?* A.—The brake pipe to the displacement reservoir by way of the limiting valve, until the displacement reservoir (which is connected to the chamber over the limiting valve diaphragm) pressure has reached 14 lb. The brake pipe to the vent valve chamber and over the accelerated release check and chamber F in the release insuring valve portion. Auxiliary reservoir to displacement reservoir. Auxiliary reservoir to release insuring valve portion and to auxiliary reservoir check. Displacement reservoir to safety valve, and face of the emergency valve. Emergency reservoir to the spring side of the emergency valve. Emergency reservoir to chamber above spill-over check, valve and chamber over the emergency slide valve strut diaphragm.

Emergency reservoir to the chamber above the emergency reservoir check and chamber over the emergency reservoir charging check valve. Quick-action chamber to atmosphere by way of the emergency graduating valve and slide valve.

476—*Q.—What is the purpose of the accelerated release check valve and ball?* A.—To provide accelerated built up of brake pipe pressure, after an emergency, from the combined volume of auxiliary and displacement reservoir when the slide valve moves to an accelerated release position.

477—*Q.—For what purpose is the diaphragm spring and slide valve strut?* A.—It serves to keep the slide valve seated in the absence of quick action chamber pressure.

Decisions of the Arbitration Committee

(*Continued from page 325*)

that, until the rules are modified to place flood damage under Rule 4, Section (k), there is no infraction of the rules under which these charges were rendered.

In a decision rendered November 17, 1938, the Arbitration Committee stated: "The contention of the Baltimore & Ohio is not sustained."—*Case No. 1,763, Baltimore & Ohio versus Missouri Pacific.*

[NOTE: In the report of the Arbitration Committee presented and accepted at the 1939 A. A. R. Mechanical Division Convention, the committee recommended that a new interpretation be added to Rule 4, to become effective August 1, 1939, which states that in cases where whole or part of superstructure is involved through general statement of damage, car owner must accord railroad issuing the defect card the opportunity of participating in joint inspection. If the railroad issuing such defect card fails to avail itself of the opportunity of making joint inspection within 15 days from date of notification, then the joint inspection shall proceed in the manner prescribed in Section (k). The decision in this case was based on the rules in effect prior to the adoption of the new interpretation.—Editor]

Adjustment of Lading May Involve Removal and Replacement on Same Cars

On September 13, 1935, the Chicago, Rock Island and Pacific delivered two flat cars, one having a single overhanging load of piling and the other being used as an idler, to the St. Louis Southwestern. The car inspector of the St. L. S.-W. recorded that the car had an extreme overhanging load when received by him. At a later date, the C. R. I. & P. furnished the St. L. S.-W. with a car check of the form specified in the A. A. R. rules with the word "transfer" crossed out and intended this form as authority to bill for the expense of adjusting the lading. The St. L. S.-W. unloaded this lading completely and reloaded it as a twin load on the same two cars at another point where facilities were available for handling this work. The C. R. I. & P. contended that the check form which was issued did not authorize the unloading and reloading of the cars as a twin load, and considered this work to be a transfer of lading regardless of the fact that the same two cars were used.

In a decision rendered November 17, 1938, the Arbitration Committee stated: "The contention of the Chicago, Rock Island & Pacific is not sustained."—*Case No. 1,764, St. Louis Southwestern versus Chicago, Rock Island & Pacific.*

IN THE BACK SHOP AND ENGINEHOUSE

There's Always A Way

By Walt Wyre

The job of being a mechanic around a railroad is one that requires, above all else, the ability to dip into the well of past experience and come up with the solution to the problem of the moment. In this month's story Walt Wyre is taking us on a personally conducted tour of the S. P. & W. with Henry Barton, "who does the welding at the Plainville roundhouse." The leaky fuel tank of the 5091 calls for a neat job of designing in addition to the welding. The fire-door hole on the old locomotive boiler at Middleton requires another brand of ingenuity including holding at bay a too-helpful helper and, that the day might not be too dull, Evans wanted "to get your idea on building a furnace for annealing drawbars." Being a railroad mechanic, he had his say—"but I'll think about the furnace." By now it is probably finished.

ROUNDHOUSE foremen are always hopeful of getting one more trip out of a locomotive before tying it up for repairs. Jim Evans is no exception. He knew that the fuel oil tank on the 5091 was leaking. It had been reported the last three trips and oil leaks have a habit of getting worse instead of better. Evans did figure he could get one more trip out of the engine before repairing the leaking tank. When he looked at the tank he changed his mind and revised his engine lineup for the day and went in search of Henry Barton that does the welding at the Plainville roundhouse.

"Seems like we are having a lot of trouble with fuel oil tanks leaking," Evans told Barton.

"That's right," Barton admitted, "we are. There's a lot of weight on the bottom of the oil tanks and even if they are blocked in good and solid, they're bound to do a lot of working."

"We've had this tank out three or four times in the last six months, and some of the others are almost as bad." Evans turned to go to the office. "When you get this one out, see if you can't figure some way to repair it so it will last a while."

"I've been thinking about that," Barton said, "and believe I have a plan worked out, if we can get the time."

"How long will it take?" the foreman asked.

"About three or four days," the boilermaker said, "if we don't have too much other work."

"I'll tell the hostler to spot the engine and drain the oil out. When you get the tank lifted up we'll look at it and talk about your idea for repairing it. I'm afraid we can't tie the engine up that long," Evans said.

When the S. P. & W. changed from coal to oil, the fuel oil tanks were designed to fit in the space formerly used for coal. The oil tanks, as a result, are built with sides and back that flare out to fit the slope of the coal space. This makes the bottom of the tank small as compared with the top.

In order to keep the weight down as much as possible, the tanks were built of quarter-inch tank steel. Several years' service showed that the bottoms should have been heavier, but flanging and fitting a new bottom is a job that calls for more equipment than is usually found at a roundhouse.

The oil tank of the 5091 was drained and flushed out. Then the tank was spotted under the derrick and the tank hoisted up. Barton was measuring the space where the tank fitted when the foreman came out to see how much of a job it was going to be to repair the leak.

"What do you think?" Evans asked. "Is it much of a job to fix it?"

"Oh, I can chip the crack out and weld it in a little while, but it'll be leaking again after a couple of trips. We might as well fix it right while we've got it out."

"But the 5091 is a good engine," Evans protested, "and I can't tie it up three or four days. Couldn't you get it done sooner?"

"Afraid not," Barton replied. "But why don't you use the tank off the 5087? It'll be two weeks before she will be off the drop-pit, won't it?"

"That's right"—Evans pulled out his plug of "horseshoe"—"I'll have the painter change the numbers on the tank."

"Guess I've stuck my neck out again," Barton said to his helper. "But it's a good idea if it works."

"What are you going to do?" the helper wanted to know.

"The first thing," Barton replied, "is to get this oil tank on the ground and bottom up. The next is to get that sheet of ⅜-inch steel I've got stacked away behind the steel rack."

"I wondered what your idea was hiding that steel," the helper said.

The bottom of the oil tank had been repaired many times. Most of the breaks had been along the seam where the bottom was welded to the sides; evidently caused by vibration.

"What are you going to need?" Barton's helper asked.

"The first thing is a cutting torch."

It didn't take long to cut the bottom out of the tank. Forming the new one of ⅜-inch steel by hand did take considerable time. When finished, the bottom of the tank resembled a rectangular bucket lid with a ⅜-inch flange.

"Say," the helper exclaimed when they were putting the finishing touches on the tank bottom, "haven't you got it too big to fit inside the tank?"

"It's not going to fit inside," Barton replied. "It's going to fit over the outside."

It required a little heating and hammering to make the heavy steel bottom fit the sides of the tank snugly, but it was done, and it was ready for the seam to be welded.

"That ought to hold it," helper remarked when Barton lifted his welding shield and laid down the electrode holder.

"It will when I get through," Barton said. "I'm going to weld a sheet of quarter-inch steel on the sides up to where the flare starts. That will stiffen it and keep it from breaking at the seams."

"Well, it looks like a good job," Evans remarked when the tank was ready to go back in place. "Wish we had time to fix them all like that," he added.

"I thought we might get started on the 5092 right away," Barton said. "It's in pretty bad shape."

"Too much other work right now," Evans replied, "and by the way, you've got to go to Middleton in the morning to repair a stationary boiler. I don't know just what there is to be done. Better get your tools together this afternoon."

MIDDLETON was once an important point on the S. P. & W. That was before they started running trains through. Now about all that is left of the roundhouse and shops is a dilapidated turntable with a lot of vacant space around it. There is not even any compressed air to operate the motor that was used to turn the table.

There is an office that looks like it was left standing because the warped and weathered boards weren't worth saving. The only buildings that have been kept in presentable repair are the pump houses and stationary plant. The latter supplies steam for heating fuel oil and operating water and oil pumps.

"Better take everything with you that you are likely to need," Evans told the boilermaker. "You won't find anything in Middleton."

Barton took the foreman at his word and filled a huge box with tools. He and his helper hauled the tool box to the station that afternoon. He and the heavy tool box both left next morning on the same train.

When Barton found that the boiler house was nearly a mile from the passenger station, he went to the little office building in hopes of getting help to handle the heavy tool box. There was no one around. He went on up to the boiler house.

A switch engine was standing beside the house. A fireman was sitting in the cab nodding drowsily. "Say," Barton yelled to be heard over the noise of the locomotive blower, "I've got to have some help to get my tools over here."

The fireman leaned out the cab window. "Help is one thing you won't find around this place."

"How am I going to get my tools over here?" Barton was beginning to wish he had brought his helper with him.

"There's a wheelbarrow in the stationary house," the fireman replied.

Shoving a heavily loaded Irish buggy over a hard surface is work, and the path from the station platform to the boiler house is far from being a cement walk. Besides loose gravel and soft dirt there are half a dozen tracks to cross and no crossings.

Sweating, swearing, and shoving, Barton finally made it just as the fireman blew the locomotive whistle for twelve o'clock noon.

Before going back to work after lunch, Barton went by the telegraph office. There was a wire wanting to know how he was getting along with repairing the boiler and when it would be ready to put back in service. It was from the division engineer.

"What will I tell him?" the operator asked.

"Tell him," Barton replied, "they had better send an engine up to relieve the one being used for steam. From the way it looks now the one they are using will be due for an annual inspection before this job is finished. I haven't even had a chance to look at the job yet."

"I'll tell the division engineer you'll wire later," the operator said.

"O. K." Barton turned and headed for the boiler house. He was prepared for the worst when he looked at the boiler and that's what he found.

The boiler was an old style locomotive type. Rusty streaks around the fire door ring showed where at least part of the repairs were needed. Further inspection showed no other serious leaks. A few flues would need a little caulking. Several places in the side walls could be repaired the same way, although chipping out and welding would be much better.

Barton started first on the big job. He got caulking chisels and hammer to see how that would work. The third blow drove the caulking chisel through the rusted edge where the boiler shell joined the fire door ring.

"It's in kinda bad shape." The fireman had come into the boiler house to watch.

"Yes," Barton replied. "It'll take more than caulking to repair that. It's all rusted out."

"What are you going to do about it," the fireman asked.

"Is there any place an electric welder can be hooked up?"

"There are some wires right outside the building." The fireman pointed with his thumb. "I guess one could be connected to them."

"Well, I'm going to wire the master mechanic at Plainville to send an electric welder and an electrician. Wish I had a bicycle," Barton added as he started back to the station. He also asked that a fire door frame for a 700 Class engine be sent.

The next thing needed was a cutting torch. For a wonder, there was an outfit in the water service shop.

While the fireman watched, Barton worked. He slid into the damp fire box and started on the inside shell cutting around the fire door ring. When that was finished, he did the same on the outside shell which left a rectangular opening where the fire door had been.

"Got a piece of string?" he asked the fireman.

"Going to try to tie them two edges of the boiler shells together?" the fireman inquired jokingly.

"No," Barton replied. "Going to hitch that bull of yours outside. Didn't you ever hear of laying out an ellipse with three pins and a string?"

The string was found. Barton measured and made a mark on either side of the opening and then one above to mark the edges of the oval opening.

"Now what?" the fireman asked.

"Here, I'll show you. Hold the end of the string on that mark on the left. Now bring it over my finger." Barton placed the index finger of his left hand on the mark over the opening. "And," Barton continued, "bring the string to the mark on the right of the door and hold it."

When that was done, Barton removed his finger and using a piece of soapstone in the loop of the string, traced the opening as he had learned years before.

When the opening was cut out, Barton set to work heating and hammering to force the two edges of the boiler shell together.

By the end of the second day, Barton was ready for the welder. The two edges of the outside and inside shell of the boiler had been brought together and V'd

out, but the welder had not arrived. The morning of the third day there was a message that the welder and an electrician would arrive together that morning.

It was a bigger job to get the welding machine to the boiler house than it had been to get Barton's tool box over, but there was more help. The machine was loaded on a baggage truck and hauled over.

Ned Sparks, the electrician, had brought along an assortment of wires to be used connecting the machine.

"How long will it take to get the welder going?" Barton asked.

"Not very long if"—Sparks was looking at the wires overhead—"if that is a three-phase circuit, which I doubt."

It wasn't. The circuit was for lights and the welder motor would not run on it. The rest of the afternoon was spent by the electrician trying to figure out some way of getting the welder going. Barton chipped out two or three small cracks in the fire box. He used air from the locomotive reservoir to operate the air gun.

By five o'clock the electrician was ready to give up. He had figured every way he could think of to get the proper current to the welder, but there wasn't any practical way it could be done.

"What are you going to do about it?" Sparks asked Barton.

"Huh!" the boilermaker snorted. "I'm not an electrician! You get the welder going and I'll do the work."

By this time the wires between Plainville and Middleton were beginning to droop with the heat of messages wanting to know why the delay getting the boiler going. The superintendent had gotten in on it and was urging the master mechanic. The trainmaster was raising thunder about needing the switch engine that was furnishing steam.

"It looks," said Barton, "as if things had come to an impasse, whatever that is."

"If it means a helluva mess," Barton said, "things have come to it. But we've got to figure out something."

"I've got a good notion to catch the Limited tonight and go back to Plainville," the electrician said.

"There'll be two of us if you do," Barton said. "Maybe you can figure out something in the morning."

Next morning the electrician went up town. Barton set to work drilling and tapping holes in the boiler to fasten the fire door frame. It was slow, tedious work drilling the holes with an air motor even with the pumper helping. He had obtained authority to use the pumper who turned out to be a fairly intelligent helper.

It was almost noon when the drilling and tapping was finished and no signs of the electrician. The electric welder was still standing on the baggage truck by the side of the pump house.

Barton sat down in the boiler house door to rest a moment and take a smoke when he saw a ramshackle truck approaching. As the truck drew nearer he recognized the electrician sitting beside the driver. The truck pulled up and stopped about a hundred and fifty feet from the boiler house. Barton walked over to investigate.

"Did you finally figure out a way to get the welder going?" Barton asked.

Sparks slid from the truck. "Do you know anything about welding with alternating current?"

"Never tried it," Barton said, "but guess I could if I had to. Is that an a. c. welder? What have you got two for?"

"Those are transformers," the electrician said. "When I get through connecting them up you'll be able to weld with them—I hope."

The driver of the truck was a mechanic that operated a garage and general repair shop in town. He and Barton helped the electrician string out the wires.

When it was finished, two wires from a line about three hundred feet away were connected to one of the transformers and the two transformers were connected together. The leads from the welding machine were removed and connected to the transformers.

Barton tried welding first on a piece of steel he picked up. The metal sputtered and spattered like chicken livers in hot grease.

"Say, I can't weld with that arc. It's wild as the division engineer will be when he gets my wire telling him the job is blowed up."

The electrician scratched his head thoughtfully and said nothing.

"Say!" Barton exclaimed, "I'm no electrician, but maybe if you run the current through the reactor coil on the welder it would help."

"I believe you've got something," Sparks said.

When the electrode wire was cut and the ends connected to the reactor, Barton tried again. After two or three attempts he held a fairly steady arc.

"What do you think?" Sparks asked anxiously.

"Well," Barton replied, "I don't know what the job will look like, but guess I can make it. I couldn't if I wasn't using heavy coated welding wire, though."

The job was finished and didn't look so bad either.

A FEW days later Evans sent for Barton to come to the roundhouse office. "I wanted to get your idea on building a furnace for annealing drawbars," Evans said.

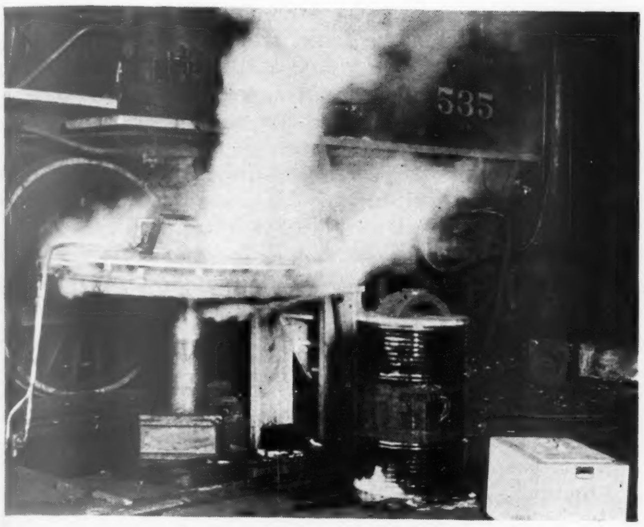
Barton stood a moment thinking, then replied, "From here on out I'm practicing birth control on ideas, at least until I get over the effects of having the last two—but I'll think about the furnace."

Method of Shrinking Locomotive Parts

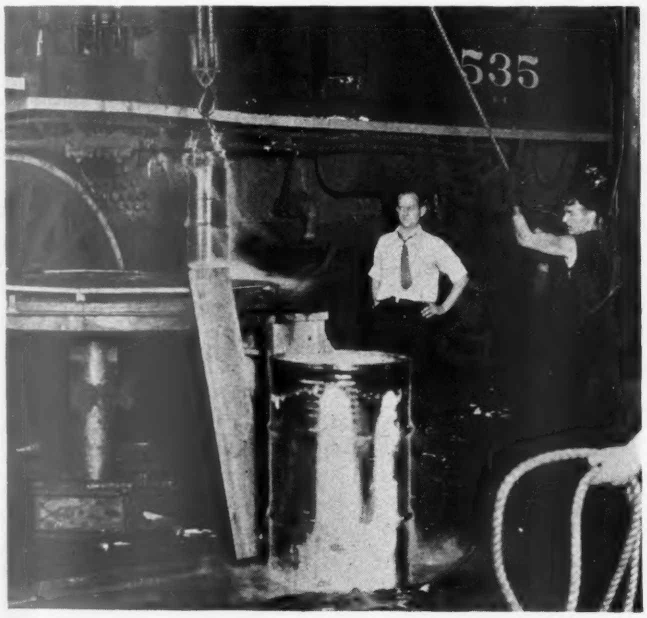
By R. T. Peabody

Within a single generation, the size of locomotives has increased until they have become giants, massive and heavy. Many parts have doubled and even tripled in size and weight. But, so far as tolerance fit is concerned, American engineers and designers have reached the

The crank pin being "frozen" in the solution

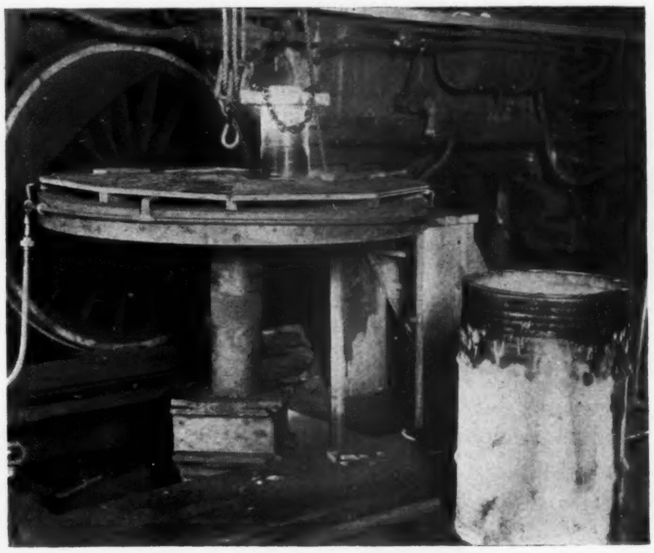


Above—Heating wheel center to 180 deg. F. with steam. Below—Lifting the pin from the cooling bath to the wheel



limit in size and weight of such parts as crank pins, wrist pins, truck wheels and axles, truck boxes, driving boxes, driving wheels, etc., fitted together under hydraulic pressure with a slight oversize tolerance, in some cases .001 in. per inch of diameter, in some cases less than that.

Ever since successfully applying brake-hanger bushings with liquid air on the Boston & Albany in 1929, the author has been working on a better method than



The cold pin being inserted in the wheel center

Tolerances Needed for Dryal Fits

PASSENGER-COACH TRUCK-FRAME BUSHINGS

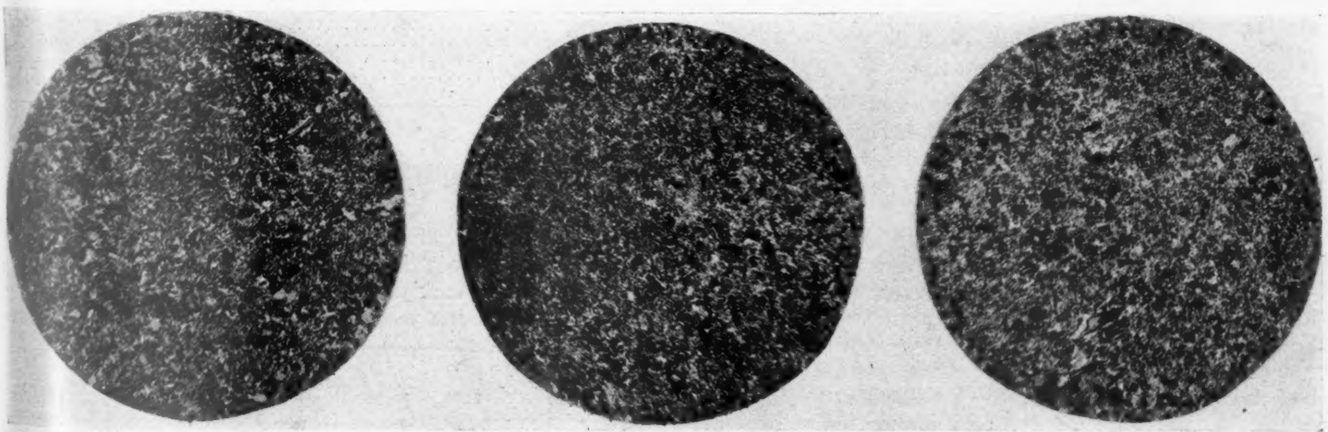
Diam., in.	Tolerances, in.	Length, in.	No. per truck
1 7/8	0.002	1 1/8	24
3 1/16	0.003	1 7/16	8

LOCOMOTIVE TENDER-FRAME BUSHINGS

Diam., in.	Tolerances, in.	Length, in.	No. per frame
6 1/8	0.006	3	4

GENERAL PURPOSE BUSHINGS

Diameter, in.	Length, in.	Proposed Tolerance, in.
1 1/8	1 1/8	.001
2 1/4	2	.002
2 5/8	3 1/2	.0023
2 5/8	4	.0023
2 3/4	1 15/16	.0025
2 3/4	2	.0025
3	2 1/4	.0027
3	2 3/16	.0027
3 1/16	1 7/16	.0028
6 1/8	6 3/8	.005
6 1/2	4	.005
7	4	.0065
7 1/8	4	.006
7 1/8	5 1/8	.006



Micro-photographs of a piece of carbon vanadium steel. At the left is the grain structure of the original steel; the center photo shows the grain after cooling to minus 60 deg. F. and quenching in oil at 180 deg. F. The photo at the right shows the grain after cooling to minus 60 deg. F. and allowing the steel to warm up to room temperature. Specimens were polished and etched with 2 per cent nitric-alcohol solution. Magnification 100 times.

hydraulic pressure for heavy locomotive parts requiring tolerance fits, and has developed a method which has been designated Dryal.

On March 30, 1939, a demonstration was made which indicated that through the use of this method locomotives can now be built with almost perfect tolerance fits.

Description of Test

A mounted scrap disc main driving-wheel center was prepared. A crank pin was immersed in a dry-ice and alcohol solution for 30 min. which reduced the pin temperature to minus 60 deg. F., and, while the pin was in the solution, the entire wheel center was heated with live steam to 180 deg. F., so that it expanded evenly. Before cooling the pin and heating the wheel the pin diameter was 9.341 in. and the wheel bore 9.331 in., indicating a shrinkage tolerance of 0.010 in.

After the pin had been chilled in the solution, it was lifted by an overhead crane, transferred to the wheel center, and slipped gently into proper position in the hole *of its own weight* with plenty of space to spare.

The pin dropped into place without any hammering or pressure and without any friction. A pressure of 275 tons was required to remove the pin, or 75 tons more than for pins inserted by the former method.

The pin remained the same, while the bore measured 9.337 in. along the center line and 9.335 in. at 90 deg. straight, proving that in the hole, which was 10 in. deep, there were 10 in. of fit. It is not possible to secure this condition by the hydraulic-press-fit method. The hole was found to be in perfect condition, the micrometer measurements indicating only 0.002 in. out of round.

The pin was tested metallurgically as to the effect of the intense cold on the metal, and the grain structure and physical properties were found to be unaltered.

The Dryal method is economical and is applicable to any locomotive or car part that requires a tolerance fit.

Application of Bushings

Cast iron, steel and bronze locomotive bushings can be applied by the Dryal method. Passenger-car truck frames with various size bushings can be assembled quicker by this method, and the bushings will wear better because of the better fit, if the proper tolerances are used. To obtain the proper Dryal fit, tolerances based on a little less than 0.001 in. per inch of diameter are most important. The accompanying tables show standard tolerances for such fits.

British and French

Staybolts of Monel Metal

By James Clayton, M. B. E., M. I., Mech E.*

IT is generally recognized by all locomotive engineers that the measure of the ability of the steam locomotive engine to perform the work required is the capacity of the boiler to produce the steam necessary for the work in hand.

Moreover the part of the boiler which is called upon for maximum output of heat units is the firebox. The inner firebox is perhaps the most arduously treated detail, for on the fireside it is exposed to the effects of the combustion of the burning fuel, urged by the blast of the engine exhaust, while on the water side it must carry the load imposed upon it by the maximum steam pressure generated. Its flat surfaces must be supported at frequent intervals by suitable staybolts fixing it securely and yet with a certain degree of flexibility to the outer casing in such a way that the active circulation of the water is not impeded. Such water-space stays or bolts must be simple in form and easy to apply and renew.

British Practice

In Great Britain the conventional form of copper firebox has been used from the earliest days and still survives here as well as on the continent of Europe. With few exceptions the water-space stays for such fireboxes have also been made of copper.

For many years the Great Western and the Southern Railways have used screwed steel stays ⅝ in. diameter for the same purposes having renewable nuts on the fire side, and screwed steam tight into the outer casing as shown in Fig. 1.

Both railways use these stays made of mild low-carbon steel having a tensile strength of 63,000 lb to 76,000 lb. per sq. in. and with 28 per cent elongation. This material complies with the specification given in the table.

Its chief property is that it is very ductile so as to withstand the bending action to which staybolts are subjected by the expansion under working conditions of the copper firebox plate in relation to the outer steel casing plate. The pitching of these stays is arranged so that they carry each approximately 2,200 lb. of load due to

Specifications of Steel for Firebox Stays

	Per cent
Carbon	0.12 to 0.18
Manganese	0.8 to 0.9
Silicon below	0.3
Sulphur below	0.07
Phosphorous below	0.07
Physical test:	
Tensile	63,000-76,000 lb per sq. in.
Elongation	28 per cent
Brinell	149 (not greater)
Izod	60 ft. lb.

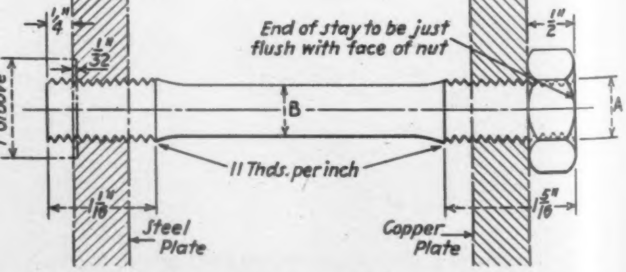


Fig. 1—Details of steel staybolts used by the Great Western and Southern railways

* Vice-president, Institution of Locomotive Engineers; past president, Locomotive & Carriage Institution, and formerly with the Southern Railway Co., Ltd., England.

the steam pressure, thus providing a good factor of safety.

Owing to the impurities in the water used, among them magnesium chloride, and the electrolytic action set up by the dissimilar metals of copper and steel, severe corrosion at the neck of the stay adjacent to the copper plate is often accentuated and cannot be located from the outside. Typical stays removed after service are shown in Fig. 2.

The usual method of detection of broken stays by tapping the firebox end of the stay with a light hammer, which is quite effective when a copper stay is broken, is of no use whatever to detect a stay well reduced in section as shown by corrosion as it would still respond as sound when tapped.

This trouble of corrosion was a very real one as encountered by the Southern and threatened the use of the small water-space stay until the advent of the use of Monel metal for the purpose. This Monel is of high tensile strength with good elongation and ductility to resist fatigue, as will be noted from the table, and is highly resistant to corrosion thus making it an ideal

Typical Physical Properties of Monel Staybolts on the Southern Railway, England

Maximum tensile strength, lb. per sq. in.	89,600
Yield point, lb. per sq. in	81,088
Elongation, per cent	24
Reduction of area, per cent	63
Brinell hardness	179

material for these stays. As an example of this from actual service conditions see Fig. 3, which is a photograph of a stay, one of six which were inserted in a firebox in the fire area for trial purposes October 20, 1922, and was removed for inspection after being nearly 12 years in service. There is not the slightest sign of

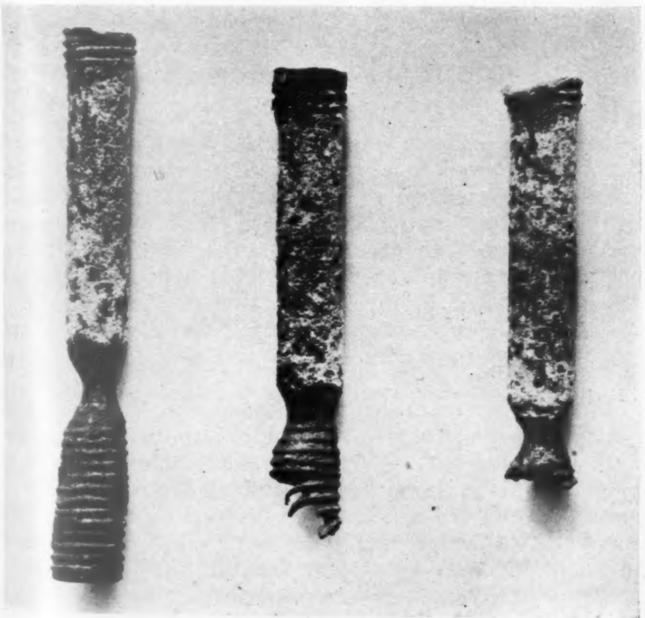


Fig. 2—Steel staybolts removed from service showing corrosion due to water impurities and electrolytic action

corrosion and the original machine marks can still be seen on the body of the stay. The Monel bar used by the Southern for these stays is of the hard, cold-drawn stress-relief annealed quality and is fabricated in exactly the same way as the mild steel stays used previously.

It is important that the threads on the stays be fully formed and of good finish so as to make contact accurately and tightly with the threads in the plate. The stays are arranged so as to project through the copper firebox plate normal to the surface—this is most important—to enable the nut to bed perfectly against the plate. If this is not done the stay end is liable to bend and fracture when the nut is screwed up to the plate and breakage may result.

The end of the stay projecting about ¼ in. through the outside firebox plate is lightly caulked by a suitable tool all around to a depth of about $\frac{1}{32}$ in., as shown in

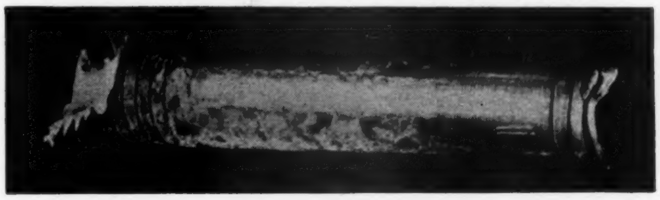


Fig. 3—Tool marks are still visible in Monel staybolt removed after nearly 12 years of service

Fig. 4, to insure steam tightness. The body of the stay, between the screwed ends, is plain and well finished with a generous radius so that abrupt change of form where the thread ends is avoided.

The nuts can be of iron or steel and should not be deeper than about ½ in., as otherwise the heat is not transmitted through to the plate rapidly enough to avoid burning the material of the nut. These nuts are cheap and can be changed frequently as they burn and deteriorate so as to protect the ends of the stays and their threads from the effects of the fire.

The London, Midland & Scottish Railway also use this type of copper-firebox staybolt made of Monel in its modern engines working up to 250 lb. per sq. in. steam pressure. The Monel bar used is of the hot-rolled quality, but otherwise the practice of this road is identical with

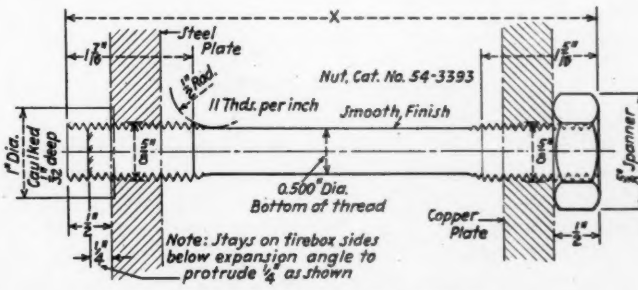


Fig. 4—Details of Monel staybolts

that of the Southern. The firebox of the Coronation Scot locomotive of the L. M. S., which has been sent with its train to the New York World's Fair, is fitted with Monel staybolts of this type. The technique of this company as regards the preparation and form of the stays and nuts is very similar to that of the Southern but the application varies slightly in some respects.

The main difference in the application of these two companies is that whereas the Southern make all the staybolts ⅝ in. in diameter the L. M. S. use $1\frac{1}{16}$ in. diameter for all the staybolts with the exception of the two top rows and the front and back rows of the sides as well as the outer rows of the back and front firebox plates which are ¾ in. in diameter. This difference in the diameter of the staybolts used may be explained by the fact that the Southern employs a higher tensile material of cold rolled Monel bar (89,600 lb. per sq. in.)

while the L. M. S. uses the hot rolled Monel bar (67,200 lb. per sq. in.). The factor of safety in each case is about the same, viz: 7.5 to 8, which is higher than that of copper at firebox temperatures.

The use of Monel for staybolts by these two railways has been proved over years in service and has reduced the cost of firebox maintenance and with less leakage under the most arduous conditions. In the past where copper stays were used the work of caulking them to prevent leakage and the reheading of the stays added not only to maintenance costs but the wear and tear on the firebox plates was also very much increased. The renewal of copper stays with ever increasing diameter to

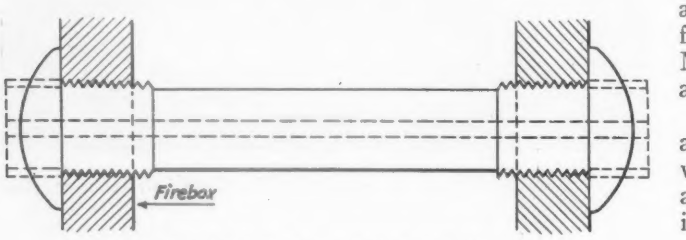


Fig. 5—Monel staybolts riveted at both ends

meet wear and tear and breakage added greatly to the cost of maintenance.

It can be stated with certainty that a broken Monel stay in service is so far unknown.

Nuts are stocked in reducing diameter of threads to allow for the wear of the threads on the stays. To meet those cases in which the screw thread has become too small for standard size nuts, a die nut is provided to rethread the end of the stay to take a smaller size nut.

Further it should be noted that copper stays have their strength very much impaired or reduced under the high temperature in the firebox so that the 31,000 lb. per sq. in. tensile strength of the copper bar under cold conditions may be reduced to 20,000 or 22,000 lb. per sq. in. Staybolts made of Monel on the other hand suffer no practical diminution of strength under the exalted temperature conditions of locomotive fireboxes.

Continental Practice

In France during the World War, owing to the difficulty in obtaining copper, hot rolled rods of Monel were used by the P. L. M. Railway for staybolts in substitution of copper, but as no reduction was made in diameter, notwithstanding the higher tensile strength of Monel over copper, they were found hard to rivet and leakage of the stays where screwed into the copper firebox occurred. These Monel rods were obtained from the United States and after the war when copper became available its use was resumed.

During the last few years the P. L. M. has had two locomotives having copper fireboxes fitted with Monel staybolts of cold-drawn hard material 18 mm. ($\frac{45}{64}$ in.) diameter having nuts on the fire side. It is said that leaking occurred but, it is agreed, this may have been due to indifferent screw threads or lack of technique in the application.

The Paris-Orleans section of the French railways has also been interested in Monel for staybolts and in 1934 fitted two Pacific type locomotives having steel inner fireboxes with these stays made of cold-drawn soft annealed Monel 23 mm. ($\frac{29}{32}$ in.) diameter, the heads of which were riveted as shown in Fig. 5. These stays were in replacement of cupro-manganese staybolts the heads of which are found to burn away rapidly. Although the results of the use of this trial of Monel staybolts are not definitely known it is understood they are satisfactory.

The railway in Alsace-Lorraine has just completed the fitting of a locomotive having the inner firebox of steel and the staybolts of 20 mm. ($\frac{25}{32}$ in.) diameter cold-drawn hard Monel, the heads of which have been welded at both ends as shown in Fig. 6.

The trials on the French railways of the use of Monel staybolts are being continued by fitting the two upper rows on each side of the steel fireboxes of locomotives now under construction as follows: 50 locomotives 2-10-0 type for the Nord, and 25 locomotives 4-6-2 type for the Sud-Est railway. For these engines the Monel stays will be 23 mm. ($\frac{29}{32}$ in.) diameter cold-drawn soft-annealed material with heads riveted at both ends. A further 10 locomotives are to be fitted similarly with Monel stays 22 mm. ($\frac{7}{8}$ in.) diameter cold-drawn soft-annealed material with heads riveted both ends.

The regulations on the French railways require that all staybolts shall be hollow. The hole through the stay while in service, is, by regular attention, kept free from any accumulation from the firebox so as to insure an indication should the stay become broken.

It was confidently stated by those consulted that so far as their trials had proceeded, no Monel stays had ever been found broken, which coincides with the experience in Great Britain where the use of Monel for this purpose is much more extended than in France.

In fitting Monel stays with the ends welded some care

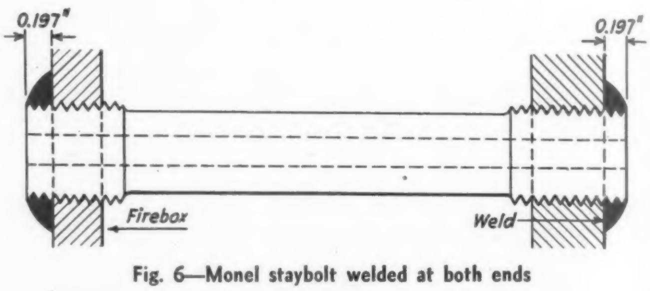


Fig. 6—Monel staybolt welded at both ends

is needed to insure a sound weld. To this end the stays are first screwed in as tightly as possibly after which the boiler is steamed so that the heat of the fire burns off all the oil from the threads, etc., before welding is commenced. In order to dissipate the heat during the process, the boiler has been filled with water, but if the threads are tightly fitting and the precaution to avoid the presence of oil is carefully observed, welding can be successfully done without the necessity of filling the boiler with water.

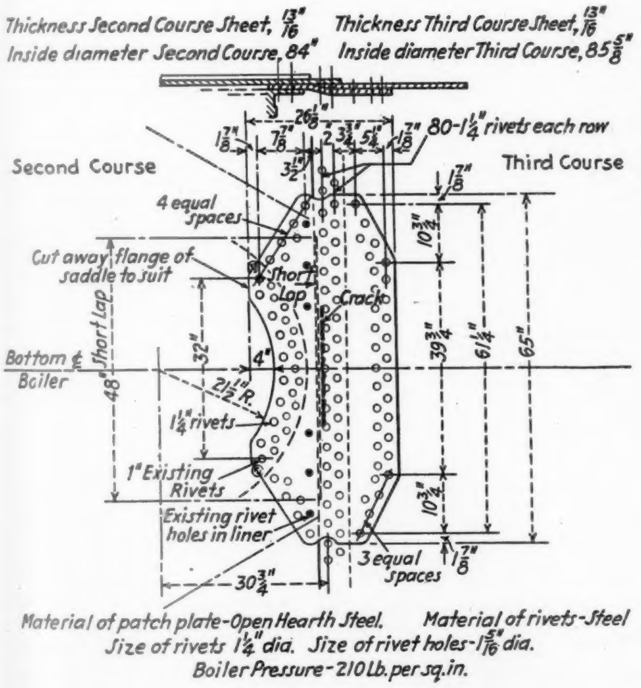
For permission to use the photographs, drawings and information illustrated and contained in this article the author is indebted to W. A. Stanier, chief mechanical engineer of the London, Midland & Scottish Railway, and to O. V. Bulleid, chief mechanical engineer of the Southern Railway, of England. The information, drawings and photographs used to illustrate the French Railway practice, etc., were provided and communicated by M. Bloch and M. Chan of the French Railways.

Employees in all classes of service on the French National Railway must average seven hours of labor per day during the summer period and seven hours 10 minutes per day from October 15 to May 15, according to a decree recently issued by the government in connection with the establishment of a 45-hour week generally in industry.

A Boiler Problem—Prize Competition

The accompanying drawing and text describe the boiler patch selected by the judges, out of 28 entries, as the winner of the first prize in the competition announced in the March issue. It was submitted by Fred W. Strachauer, district boiler inspector, Southern Pacific, Sacramento, California.

The accompanying drawing shows a patch which was applied to the barrel of a 2-8-8-2 type locomotive boiler at the seam joining the second and third shell courses, just ahead of the rear pair of cylinders. The shell was cracked in the second course through the circumferential seam at the inner row of rivets. Because of the location of the crack, unusual conditions had to be met regarding both the design of the patch and the method of application. This design of patch made it unnecessary to apply a new section of the shell. Because of the fact that the caulking edge of the third course and the cylinder casting



A boiler patch applied to the bottom of the shell which eliminated the necessity of applying a new shell course

were too close to allow sufficient space for the circumferential seam, the patch was applied as shown. In applying the patch the edge of the third-course shell sheet was scarfed under the patch and the cylinder-saddle casting was machined out to accommodate the front edge of the patch.

Had it been necessary to apply a section of the shell or a new full course, a heavy labor and material cost would have been incurred as a result of removing all the flues in the boiler. Inasmuch as the cylinder casting had to be removed anyway, it did not involve any additional expense to cut away the saddle in order to slip the patch sheet under the casting and, in order to apply the patch, only enough flues were removed to allow for holding-on the rivets for the saddle upon reapplication.

Locomotive Boiler Questions and Answers

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

The Application of Fusible Plugs

Q.—Are fusible plugs required in a locomotive boiler? If two or more fusible plugs are used, how is the number determined?—J. S.

A.—The Laws, Rules and Instructions for Inspection and Testing of Steam Locomotives and Tenders and their Appurtenances issued by the Bureau of Locomotive Inspection, I. C. C., does not require that fusible plugs be used in locomotive boilers; however, Rule 14 states that if boilers are equipped with fusible plugs they shall be removed and cleaned of scale at least once every month. Their removal must be noted on the inspection report.

The Committee on Fusible Plugs at the 1933 Convention of the Master Boiler Makers' Association recommended that when a multiple application of fusible plugs is used in a locomotive boiler, one plug should be placed at the highest point of the crown sheet between the first and second rows of stays and one additional plug for each 400 sq. in. of gas area of the flues. It was also recommended that these plugs should be spaced uniformly in the crown sheet on each side of the top center line of the crown sheet from front to back.

Correct Steam Piping to Dual Air Compressors

Q.—We have recently applied an additional air compressor to our 4-8-4 locomotives, which are now equipped with two compressors located on the bumper deck casting directly ahead of the smokebox. Since making this change we find that the air compressor on the left side seems to lag as compared with the one on the right side. What would cause such a condition?—R. E. C.

A.—The question does not go into any detail as to the manner of applying the compressors, especially in regard to the manner of piping. The trouble experienced would indicate that the steam supply to the compressors was not being distributed equally, one compressor getting considerable more than the other. The steam supply from the turret is generally brought from the steam turret to the compressors by a single 1½-in. line and at the compressors divided into two 1¼-in. lines, one to each compressor. It is important that where the division is made, a suitable fitting be used so that the steam is properly divided between the two outlets; tees should be avoided. Side-outlet elbows, Y-fittings or specially designed fittings should be used to insure a proper distribution of the steam to the two compressors. Also, it is important that the length of the pipe from the dividing fitting to the compressors be the same for each compressor; this can readily be arranged at the time the compressors are piped.

High Spots in
Railway Affairs . . .

Railroad Legislation Marking Time

The House of Representatives late on July 26 passed Railroad Bill S. 2009 after long, heated discussion and many amendments. At one time during the discussion Representative Martin, Democrat, of Colorado, suggested that the measure "rather than being for the benefit of the railroads" was rapidly becoming "a bill for the benefit of the waterway carriers, plus a lot of exemptions for agriculture." The bill as passed by the House varies in so many respects from that passed by the Senate, that there is little possibility of adjusting the differences between these two bodies in time to enact the legislation before adjournment. Senator Wheeler indicated that he would ask the Senate to send the bill to a joint House-Senate Committee for study and adjustment during the fall. It could then be passed promptly when Congress reassembles in January. Certainly, however, if it is to be of any great benefit to the railroads a lot will have to be done to it before it comes out of conference. Sharpshooting by high pressure groups in the House certainly put the kinks in it.

Transportation Round Table

The magazine Fortune recently called together 15 well-known men representing different interests, to discuss "Transportation Policy and the Railroads." Naturally there were many questions on which a group of such wide and varied interests could not see eye to eye, but here are six major principles of a national transportation policy upon which the round table unanimously agreed:

"(1) The railroads and other forms of internal transport should be placed upon an equal basis insofar as regulation and alleged government subsidies are concerned, except during a promotional stage.

(2) The principle of low rates should be the constant aim of transportation policy, and the carriers and Interstate Commerce Commission should remove any unjust regional preferences and work toward the gradual simplification of the general rate structure.

(3) The railroads should reduce costs, possibly by $300,000,000 a year, through effecting consolidations and co-ordinations.

(4) Any workers adversely affected by such economies should be protected by a dismissal wage; if given communities cannot afford to support given transportation facilities, such facilities should be either abandoned or frankly subsidized by government.

(5) A temporary government transportation committee should be established to co-operate with the carriers in effecting these and other economies and to lay the foundations for a national transportation policy, aimed at developing each branch of transport in accordance with its inherent advantages.

(6) Although the rehabilitation of the railroads will contribute to general recovery, we can have a healthy transportation system only when we have a healthy economy."

Unemployment Insurance Payments Start

Payments under the provisions of the Railroad Unemployment Insurance Act, which was rushed through Congress near the close of the session a year ago, were started about the middle of July this year. It may be recalled that the statement was made last year by the publication "Labor" that this particular bill went through the Senate "in exactly 4½ minutes—breaking all records for speed in enacting legislation." The benefits are payable for a maximum period of 80 days to those workers who qualify and can show that they earned $150. in the previous year. Benefits computed on a daily basis range from $1.75 to $3. per day, so that the maximum payable to any one individual is $240. a year. The Railroad Retirement Board announced that about 65,000 claims for benefits are on file.

Changes in High Places

July witnessed several changes in important executive positions. Upon the retirement of Hale Holden as chairman of the Southern Pacific, the headquarters of that road were shifted from New York to San Francisco, leaving only the financial officers in the East. A. D. McDonald, the president, took over the duties and authority of the chairman. Four new directors were elected, all from the West Coast, and the new executive committee now consists entirely of West Coast members. * * * * * Near the end of the month Rowland L. Williams was made chief executive officer of the Chicago & North Western, succeeding Fred Sargent, who resigned on June 1. Most of Mr. Williams' railroad career has been with the Chicago & Eastern Illinois. After having had experience in several departments he became chief statistician and then was assigned to special research, in the effort to improve the efficiency of operation and effect economies. He made good to such an extent that he was senior executive assistant of the C. & E. I. when called to the North Western.

Railroad Employment Going Up

According to the Interstate Commerce Commission's compilation, based on preliminary reports, the number of employees on Class 1 railroads, excluding switching and terminal companies, on June 15, 1939, was 991,900, an increase of 3.58 per cent over May 15 of this year, and of 8.39 per cent as compared to June 15, 1938. One must go back to December 15, 1937, to find a higher figure, 1,006,462; never during the year 1938 did it approach the million mark at the middle of any month. In that year a low of 905,573 was registered in May, and a high of 976,374 in October. In only one month, however, did it go below the million mark in 1936. It was 981,853 on January 15, 1936—the high for that year being 1,108,970 in October.

Mechanical Equipment Costs

Each year the Engineering Section of the Bureau of Valuation of the Interstate Commerce Commission publishes cost statistics for railroad construction. The index number for steam locomotives in 1938 was 204, exactly the same as in 1937. It was 86 in 1915, advancing rapidly during the following years until it reached 248 in 1920. It dropped back sharply to 192 in 1921 and to 179 in 1922. It bobbed back up to 197 in 1923, but since that time never went above 194 (1930) until 1937, when it reached 204, as above noted. The story for freight cars did not follow quite the same course. From a low of 101 in 1915 it advanced to 284 in 1920, dropping back to 184 in 1921 and 156 in 1922. It climbed back up to 200 in 1923, but remained well below that figure until it jumped from 179 in 1936 to 191 in 1937, dropping back a point to 190 in 1938. The story of passenger train car prices is not nearly as exciting, possibly because there was less pressure for increasing this equipment during the war years than was true in the case of locomotives and freight cars. From a low of 89 in 1915 it advanced to a high of 213 in 1920, dropping to 169 in 1921 and 152 in 1922. It climbed back up to 192 in 1923, but except for 191 in 1927, remained below 189 until 1937, when it went to 195, remaining at the same figure for 1938.

(Turn to next left-hand page)

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Among the Clubs and Associations

Four Mechanical Associations To Meet in October

PROGRAMS are being completed for the conventions of the Railway Fuel and Traveling Engineers' Association, the Car Department Officers' Association, the International Railway General Foremen's Association, and the Master Boiler Makers' Association, which will be held simultaneously at the Hotel Sherman, Chicago, October 17, 18 and 19. A general session will be held by all four associations on the morning of Tuesday, October 17, at which time the combined memberships will be addressed by L. W. Baldwin, chief executive officer, Missouri Pacific, who will speak on Training and Coaching Supervision. Following this session, each association will continue with its own program in its own meeting room.

Fuel and Traveling Engineers' Association Program

ARRANGEMENTS are being made for special speakers on Mechanical Day and Fuel Day of this association. Individual papers on fuel and locomotive performance will be presented by J. G. Crawford, fuel engineer, C. B. & Q.; F. P. Roesch, vice-president, Standard Stoker Co., Inc.; and W. A. Hurley, superintendent, New York, New Haven & Hartford, Boston, Mass. E. L. Woodward, western editor, *Railway Mechanical Engineer,* will discuss what members can do to promote the effectiveness of the association. Committees will report on:

Stationary Power Plants—Various Fuel-Burning Appliances That Affect Fuel Economy
Coal Preparation, Inspection and Utilization, Dealing Especially with Washed and Dried Coals
Locomotive Firing (coal), Dealing Especially with Honeycombing
Locomotive Firing Practice (oil)
Steam Turbine and Steam-Condensing Locomotives
Air Brakes
Fuel Records and Statistics
Grates
Utilization of Locomotives

Car Department Officers' Association Program

ROY V. WRIGHT, editor, *Railway Mechanical Engineer;* C. H. Dietrich, executive vice-chairman, Freight Claim Division, Association of American Railroads, and Leroy Kramer, vice-president, General American Transportation Corporation, are among the speakers on the program of the Car Department Officers' Association. On the successive days of the meeting committee reports will also be presented on Freight and Passenger Car Construction and Maintenance; Shop Operation, Facilities and Tools; Passenger-Train-Car Terminal Handling; Lubricants and Lubrication; Freight-Car Inspection and Preparation for Commodity Loading; Interchange, and Loading Rules, and Billing for Car Repairs and Painting.

General Foreman's Association Program

SPEAKERS scheduled to address successive sessions of the General Foremen's meeting and the subjects of their talks are: D. S. Ellis, chief mechanical officer, C. & O.—Proper Maintenance of Modern Locomotives; A. H. Williams, general supervisor of apprentices, Canadian National—Training of Apprentices; Fred H. Williams, assistant test engineer, Canadian National—Failures of Locomotive Parts and How to Prevent Them, and F. E. Lyford, trustee, New York, Ontario & Western—What I Expect of My Supervisors—and Why! There will also be an address by a representative of the Allied Railway Supply Association and a number of papers on various practical aspects of the maintenance, repair, or servicing of locomotives. Reports will also be made on the recommendation made at the meeting last October of the officers and executive committee of the International Railway General Foremen's Association that the name of the association be changed to the Locomotive Maintenance Officers' Association.

Master Boiler Makers' Association Program

TENTATIVE plans for the meeting of the Master Boiler Makers' Association call for addresses by the president of the association, William N. Moore, general boiler foreman, Pere Marquette; by Roy V. Wright, editor, the *Railway Mechanical Engineer;* D. S. Ellis, chief mechanical officer, Chesapeake & Ohio; by F. K. Mitchell, assistant superintendent of equipment, Cleveland, Cincinnati, Chicago & St. Louis, and by J. M. Hall, chief, Bureau of Locomotive Inspection, Interstate Commerce Commission. Committee reports will be made on nine topics:

Technical and practical training of boilermaker apprentices; Advantages and disadvantages of all-welded and alloy steel for locomotive cisterns to decrease weight and reduce pitting and corrosion; Means to further improve steaming qualities in the locomotive boiler and eliminate leaking staybolts and cracking of firebox sheets; Treating boiler feedwater chemically; Standard practice for locating height of crown sheet, water-glass and gage cocks and low-water-alarm drop pipe; Cause for flues and tubes cracking longitudinally through head; Recommendations for standardizing inspection, testing, and cleaning of locomotive air reservoirs; Recommendations for the renewing of fireboxes, and topics for 1940 meeting. An individual paper on the first topic will be presented by a representative of the Federal Committee on Apprenticeship, United States Department of Labor, Washington, D. C.

Machine Tool Show at Cleveland, Ohio

THE 1939 Machine Tool Show of the National Machine Tool Builders' Association will be held at the Cleveland Public Auditorium from October 4 to 13 inclusive. The member companies of the Association are making an outlay of over $3,000,000 to assemble a machine tool and allied equipment display involving more than 1,000 machines of approximately 600 types. In extending an invitation to railroad men to visit this year's show W. E. Whipp, president, Monarch Machine Tool Company and president of the National Machine Tool Builders' Association says, "To railroad men concerned with problems of operating costs in repair and maintenance shops, this show will display many new developments worth careful study. Improvements in machine-tool design developed during the past five years and now being included in new machines have made remarkable strides in the direction of increased productivity and economy of operation. In these days when costs must be pared to the bone and profit margins are mighty slim at best, the Machine Tool Show may present to railroad executives opportunities for savings in operating expenses far greater than have heretofore been possible."

During the show there will be a number of technical meetings with programs sponsored by the American Society of Mechanical Engineers, American Society of Tool Engineers, American Foundrymen's Association, Society of Automotive Engineers and the Cleveland Engineering Society.

The arrangements for the Machine Tool Show are under the direction of a Show Committee headed by Walter Tangeman, vice president, Cincinnati Milling Machine Company.

Eastern Car Foreman's Outing

APPROXIMATELY 200 railroad and supply men and guests attended the annual outing and golf tournament of the Eastern Car Foreman's Association at the Race Brook Country Club, New Haven, Conn., on Thursday, July 13. A number of prizes were awarded in the golf tournament, the winners of which were as follows: Class A—Low gross, T. M. Ferguson, American Arch Company; low net, H. Nuhn, B. & A. Class B—low gross, W. K. Krepps, Crucible Steel Company; low net, A. W. Brown, Air Reduction Sales Company. Class C—low gross, E. W. Ball, N. Y. N. H. & H.; low net, G. A. Price, American Arch Company. The arrangements for the outing were under the direction of J. P. Egan, president of the association and F. H. Becherer, general chairman.

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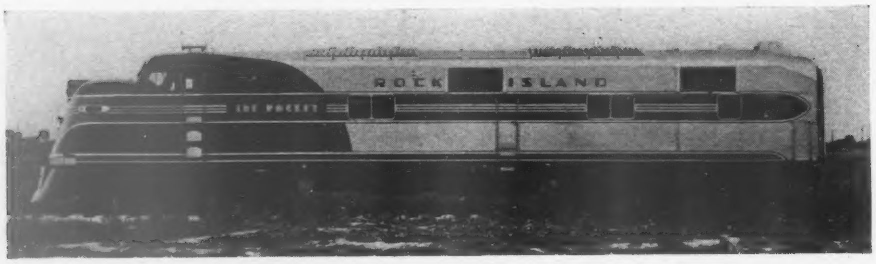
NEWS



The first of two 2,000-hp. Diesel-electric locomotives to be completed at the plant of the Electro-Motive Corporation for use on the Denver Rocket of the Chicago, Rock Island & Pacific between Chicago and Denver—The locomotive, which is now being operated in test runs, is 71 ft. 4 in. long, weighs 206,490 lb., has a 2,000 hp. power plant, and is rated at a maximum speed of 117 m. p. h.—It is equipped with six-wheel trucks

Equipment Depreciation Orders

EQUIPMENT depreciation rates for seven railroads are prescribed by the Interstate Commerce Commission in a new series of sub-orders and modifications of previous sub-orders in No. 15,100, Depreciation Charges of Steam Railroad Companies. The composite percentages for all equipment, which are derived from the individual prescribed rates, range from 3.1 per cent for the Western Pacific to 6.72 per cent for the Middletown & Unionville.

Other roads on the list are: Elgin, Joliet & Eastern; Flemingsburg & Northern; Minnesota Transfer; Union Terminal of St. Joseph, Mo.; and the Ventura County.

133 M.P.H. Attained on German State Railways

AN average speed of 124 m.p.h. for the 186-mile stretch between Berlin, Germany, and Hamburg was chalked up by a new three-car, Diesel-propelled train of the German State Railways recently, according to an official report of June 26. It is further stated that the new train held a top speed of 133 m.p.h. for 25 min. during the test run.

The road bed over which the test train made the record was rebuilt in 1932 for high-speed traffic, and the fast "Flying Hamburger," a pioneer Diesel streamliner, has been operated regularly over it since the spring of 1933. This train, operating daily in both directions, is scheduled to run between Berlin and Hamburg in 137 min. or at an average speed of 81.4 m.p.h.

The new train is powered by two Maybach Diesel engines of 600 hp. each. Its top speed of 133 m.p.h. is claimed to be the world's record in railroad speeds. According to *Railway Age* records the Pennsylvania Special (now the Broadway Limited) reached a speed of 127.2 m.p.h. for a distance of three miles between Elida, Ohio and AY tower on June 12, 1905.

All-Coach Fast Trains Between New York and Chicago

NEW fast, deluxe, all-coach trains with lounge-buffet facilities, porter service, individual adjustable seats and other former extra-fare amenities to which the coach traveler is becoming heir, were placed in operation by the New York Central and the Pennsylvania, respectively, between New York and Chicago on July 28. Representing the first long-distance exclusively coach trains established by any eastern carrier, the new runs offer patrons the new low-rate round-trip coach fare of $30.90 (at the rate of 1.7 cents per mile) between the two termini which became effective June 30, with no additional charges for special features.

Both trains are air-conditioned throughout; provide special dimmed illumination during sleeping hours; and carry a lounge car open for use by all passengers.

The New York Central's train is named the "Pacemaker" and operates on a schedule of 17 hours in each direction between the two points.

The Pennsylvania's "Trail Blazer" covers the westbound trip in 17 hr. and the eastbound in 17 hr. 25 min., averaging a little more than an hour longer than the fastest schedule over the route—that of the extra-fare "Broadway Limited."

Experimental Car Construction Authorized by I. C. C.

The General American Transportation Corporation has been granted authority by the I. C. C. to construct for experimental service in the transportation of caustic soda solution 50 tank-cars fabricated by the fusion-welding process.

The American Car and Foundry Company has been authorized by the Interstate Commerce Commission to construct for experimental service in the transportation of petroleum products 10 tank cars of 8000 gal. capacity, with tanks fabricated by the fusion-welding process.

Locomotive Rebuilding

The Illinois Central will convert six locomotives of the 2-10-2 type to 4-8-2 type locomotives.

The Great Northern is rebuilding 10 locomotives of the N-2 Class.

Activities of the Railroad Retirement Board

THE Railroad Retirement Board, on June 15, ordered the director of wage and service records to prescribe a change in the reporting practices of all employers who report to the Board on a weekly payroll basis whereby all compensation earned after June 30, 1939, shall be reported separately from compensation earned on or before that date. This was recommended by the director of unemployment insurance in view of the provisions of the Railroad

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New Equipment Orders and Inquiries Announced Since the Closing of the July Issue

LOCOMOTIVE ORDERS

Road	No. of Locos.	Type of Loco.	Builder
Seaboard Air Line	2[1]	2,000-hp. Diesel-elec.	Electro-Motive Corp.

PASSENGER-CAR ORDERS

Road	No. of Cars	Type of Car	Builder
A. T. & S. F.		See Note[2]	....
Seaboard Air Line	14[3]	Lightweight	Edw. G. Budd Mfg. Co.

FREIGHT-CAR INQUIRIES

Road	No. of Cars	Type of Car	Builder
N. Y. C. & St. L.	10	Gon. type container	....

[1] For operation on lightweight passenger trains.

[2] The Santa Fe has ordered 11 streamline lightweight passenger cars, placing seven with the Pullman-Standard Car Manufacturing Company and four with the Edward G. Budd Manufacturing Company. The seven cars include one 36-ft. dining car, one lounge-lunch counter-dining car, two baggage-chair cars, one baggage-dormitory chair car, one chair-observation car and one club-lounge car. The four cars include two post office cars and two club-chair cars.

[3] For two streamline trains of seven cars each.

Unemployment Insurance Act which require contributions by employers based on employment after June 30, 1939.

The general counsel of the Board has ruled that the value of meals and lodging furnished by an employer is not creditable as compensation under the Railroad Retirement Act, unless it is established that the employer and the employee have agreed before the performance of the service upon the amount of compensation, and that part of the compensation for the job was to be paid in the form of meals and lodging, and that the meals and lodging were to have a definite value.

Supply Trade Notes

J. L. LAVALLEE, sales manager of the railway sales division of The Texas Company, New York, has been appointed manager of the railway traffic and sales department at New York, succeeding W. E.

J. L. Lavallee

Greenwood, retired. Mr. Lavallee entered The Texas Company's service at Houston, Tex., in November, 1922, after many years experience in railroad service as lubrication engineer. He was appointed assistant manager of railway sales at Chicago in July, 1928, and sales manager at New York in October, 1937. Mr. Greenwood, who retired on June 30, entered service in April, 1912, as representative of the railway sales division at New York, advancing successively to the positions of assistant manager, manager, and general manager.

◆

C. H. WILLIAMSON has been elected vice-president of the Youngstown Steel Door Company, Cleveland, Ohio. Mr. Williamson was born on December 29, 1884, at Renova, Pa., and was educated at Dickinson Seminary, Williamsport, Pa. He entered the Townsend Scientific school of the University of Pennsylvania with the class of 1907, and in October of the following year went with the Pennsylvania

C. H. Williamson

Railroad as car repairman at Bellwood, Pa. In January, 1909, he was transferred as draftsman to the office of the general superintendent of motive power; in March, 1917, became assistant foreman of freight-car design, and in September, 1918, was made foreman in charge of freight-car design. He resigned on April 1, 1920, and became associated with the development of steel doors for box cars, becoming mechanical engineer of the Youngstown Steel Door Company, with headquarters at Cleveland, when that company was organized in January, 1925. In June, 1935, he was appointed assistant vice-president.

◆

M. ISELDYKE, JR., vice-president of The Q & C Company, New York, has been elected president. R. R. Martin, who has been with the company for 24 years, was elected secretary and treasurer. Both of these officers will also serve on the board of directors. W. M. Vinnedge, southeastern railroad sales representative of the Worthington Pump & Machinery Corporation at Harrison, N. J., has been appointed eastern district sales manager of The Q & C Company, with headquarters at New York.

M. Iseldyke, who started his career in the mechanical department of the Delaware, Lackawanna & Western, has been

M. Iseldyke, Jr.

with The Q & C Company since 1913, serving as secretary for a number of years.

W. M. Vinnedge was born on March 15, 1895, at Lafayette, Ind., and was educated in electrical engineering at Purdue university, graduating in 1916. After his graduation he entered the service of the Western Electric Company as an apprentice at Pittsburgh, Pa., being transferred to the sales department with headquarters at Omaha, Nebr., in 1917. Shortly thereafter, Mr. Vinnedge went with the General Electric Company as a sales engineer at New York, remaining with that company until 1921, when he became connected

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* * *

Samuel M. Vauclain inspecting the first locomotive of an order of twenty-eight 4-8-8-2 type now under construction at the Baldwin Locomotive Works for the Southern Pacific, following ceremonies on July 13, the locomotive was formally delivered to F. E. Russell, mechanical engineer of the Southern Pacific. President Charles E. Brinley of the Baldwin Locomotive Works is looking down from the cab window

with the American Brown Boveri Company, as a sales engineer at Camden, N. J. In 1925 he became manager of sales of portable air compressors for Metalweld, Inc. Five years later, when the business of Metalweld was acquired by the Worthington Pump & Machinery Corporation,

W. M. Vinnedge

Mr. Vinnedge entered the service of the Worthington Company as a sales representative. In 1932 he was appointed eastern regional manager of sales of locomotive feedwater heaters, with headquarters at Harrison, N. J. In 1938, he became southeastern railroad sales representative with the same headquarters.

◆

H. L. Andrews, vice-president of the General Electric Company, in charge of the company's transportation activities, is now vice-president in charge of the appliance and merchandise department, with headquarters at Bridgeport, Conn. Guy W. Wilson, assistant manager of the transportation department, has been appointed manager of that department, with headquarters at Erie, Pa., to succeed E. P. Waller, who has been appointed assistant to E. O. Shreve, vice-president in charge of apparatus sales. Mr. Waller's headquarters are at Schenectady, N. Y.

H. L. Andrews is a native of Missouri; he was graduated from the University of Missouri in 1910, with a degree of B. S. in E. E., and entered the testing department of General Electric the same year. In 1912 he was transferred to the railway motor department, and in 1916 to the railway engineering department. A year later he was placed in charge of car equipment. Late in 1925, Mr. Andrews was appointed assistant engineer in administrative charge of the department, and in 1929 was appointed engineer. He had also been responsible for general commercial matters in the transportation field. On May 25, 1934, Mr. Andrews was elected vice-president in charge of the activities connected

H. L. Andrews

with the electrification of steam railroads and such other duties as might be assigned to him by the president. In June, 1935, Mr. Andrews assumed responsibility for all departments of the company's transportation activities.

Guy W. Wilson, who has been appointed manager of the transportation department, entered the employ of the General Electric Company in June, 1923, immediately after his graduation from Penn State University. He served on "test" for six months and in December was assigned to the fac-

Guy W. Wilson

tory division of the railway equipment and engineering department at Schenectady. Since May, 1926, he has been associated with the general office division of that department at the Erie works, until last month when he and Henry Guy were named assistant managers.

E. P. Waller, who returns to Schenectady with his new appointment as assistant to vice-president in charge of apparatus sales, entered the employ of the General Electric Company in 1900, upon graduation from the Virginia Polytechnic Institute. After two years in "test," he became associated

E. P. Waller

with the publication bureau, forerunner of the present publicity department. When the General Electric Review was instituted he became associate editor, leaving in 1903 to take up commercial work in the railway department. In 1912 Mr. Waller was appointed assistant manager of the railway department and in 1922 was named manager of the department, which later was renamed the transportation department.

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J. T. Gillespie, Jr., assistant manager of the central division of railroad sales of the Air Reduction Sales Company at Chicago, has been appointed assistant to Thomas B. Hasler, president of the Wilson Welder and Metals Co., Inc., an affiliate of

* * *

Expanded plant of the American Manganese Steel Division of the American Brake Shoe & Foundry Company at Chicago Heights, Ill.

Among the new buildings are an employees' welfare building, a heating plant, and additions to the foundry, pattern storage, machine shop, and shipping room.

AIRCO. Mr. Gillespie will have his headquarters at New York and in his new duties will handle promotional sales activities in co-operation with I. B. Yates, general sales manager of the Wilson Welder and Metals Co., Inc.

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M. M. Beckwith, recently in charge of the Chemical Laboratory of the Guide Lamp Division of the General Motors Corporation, has joined the staff of The J. B. Ford Company, metal-cleaning department, at Wyandotte, Mich.

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C. D. Marshall, chairman of the executive committee of the board of trustees of Koppers United Company, resigned July 24. To succeed Mr. Marshall as chairman, the executive committee has elected J. T. Tierney. Mr. Tierney also continues as president and Mr. Marshall retains his membership on the board. Mr. Tierney will also be chairman of the board of Koppers Company, resigning his position as president of this principal operating unit of the Koppers organization. He will be succeeded as president of Koppers Company by J. P. Williams, Jr., who for some years has been vice-president of Koppers United Company and president of The Koppers Coal Company. Mr. Williams will serve also as executive vice-president of Koppers United Company.

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Standard Equipments, Chicago, has changed its name to Alcoma Railway Equipments. There will be no change in personnel and its headquarters will remain as before at 310 S. Michigan avenue.

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The Armco Railroad Sales Company has taken over the railroad sales business heretofore conducted by the Ingot Iron Railway Products Co. The Drainage Engineering Company continues to carry on its business in conjunction with Armco.

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Obituary

J. T. Geoghegan, sales engineer of the American Car and Foundry Company, at Chicago, died on June 6.

Carl Mosier, vice-president of the Union Asbestos & Rubber Co., with headquarters at Chicago, died suddenly in that city of a heart attack on July 17.

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Charles E. Robinson, who has been connected with the Baldwin Locomotive Works since 1899, died on July 20 at the age of 62, as the result of an automobile accident which occurred on July 9. Mr. Robinson at the time of his death was manager of the Engineering Department, a branch of the business in which he had held many positions during his 40 years with Baldwin.

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William R. Bush, sales representative in the eastern region of the transportation department of Johns-Manville Sales Corporation, with headquarters at Washington, D. C., died at the Lee Memorial Hospital in Norfolk, Va., July 25, after a brief illness. Mr. Bush was born in Knoxville, Tenn., in 1892 and entered service with Johns-Manville in 1921, having previously been associated with the Southern for a number of years.

Personal Mention

General

John P. Morris, whose promotion to general assistant, mechanical department, of the Atchison, Topeka & Santa Fe, with

John P. Morris

headquarters at Chicago, was announced in the July *Railway Mechanical Engineer,* was born at Fort Madison, Iowa, on March 4, 1889, and entered the service of the Santa Fe as a machinist apprentice at Fort Madison in 1904. In February, 1911, he was promoted to machinist, and in January, 1916, was advanced to assistant enginehouse foreman. Mr. Morris became general enginehouse foreman in July, 1917, general foreman in April, 1923. On November 1, 1924, he became master mechanic of the Illinois division with headquarters at Chicago; on July 1, 1937, was appointed mechanical assistant at that point, and on April 1, 1938, was appointed mechanical superintendent of the Eastern mechanical district of the Eastern lines, with headquarters at Fort Madison, Iowa.

Oscar G. Pierson, whose promotion to mechanical superintendent on the Atchison, Topeka & Santa Fe, with headquarters at Fort Madison, Ia., was announced in the July *Railway Mechanical Engineer,* was born at Topeka, Kan., on June 1, 1889, and entered railway service on April 30, 1907, as a machinist apprentice on the Santa Fe at Topeka. On April 1, 1912, he was promoted to foreman of the air-brake room and two years later was transferred

Oscar G. Pierson

to Argentine, Kan., as machinist gang foreman. On February 20, 1916, he was promoted to night enginehouse foreman at Arkansas City, Kan., and a year later was transferred to a similar position at Argentine. Mr. Pierson resigned in December, 1917, to accept work in the Navy Yard at Washington, D. C., and on January 4, 1919, returned to the Santa Fe as a machinist at Argentine. From June 19, 1919, until November 1, 1920, he served successively as machinist gang foreman, air-brake foreman, and enginehouse foreman at Argentine. On the latter date he was promoted to general foreman at Arkansas City, and on September 1, 1937, was appointed master mechanic of the Oklahoma and Southern Kansas division, with headquarters in the same city.

William H. Clegg, chief inspector of air brakes and car-heating equipment of the Canadian National at Montreal, Que., has been appointed general superintendent of motive power of the Grand Trunk Western, with headquarters at Battle Creek, Mich., to succeed Burt J. Farr, deceased. Mr. Clegg was born at Ledston, Yorkshire, England, on March 30, 1882, and entered railway service in 1902, as an air-brake repairman on the Canadian Pa-

William H. Clegg

cific at Winnipeg, Man. From 1906 to 1910, he served as a locomotive fireman, returning in the latter year to his position as air-brake repairman at Winnipeg. Later

(*Continued on second left-hand page*)

EMC "Clear-View" type Switchers are powered with the dependable General Motors 2-cycle Diesel engine which is compact—rugged, and designed to permit ready accessibility for inspection and maintenance.

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that year he was advanced to air-brake foreman at that point and in 1911, he went with the Canadian Northern (now part of the Canadian National system) as air-brake foreman at Winnipeg. Mr. Clegg was appointed air-brake instructor, with the same headquarters in 1913, and in 1916, was transferred to Toronto, Ont. In 1919, he was promoted to supervisor of air brakes, and the following year was appointed superintendent of air brakes on the Canadian National with headquarters, as before, at Toronto. His title was changed to chief inspector of air brakes and car-heating equipment, with headquarters at Montreal, in 1923. Mr. Clegg has been president of the Air Brake Association since 1930 and is also at the present time chairman of the Air Brake Committee of the Association of American Railroads.

WALTER O. TEUFEL, master mechanic on the Pennsylvania at Columbus, Ohio, has been promoted to superintendent of the Indianapolis division, with headquarters at Indianapolis, Ind. Mr. Teufel was born at Milton, Pa., on July 30, 1897, and attended Pennsylvania State College. He entered railway service on April 10, 1916,

Walter O. Teufel

as an apprentice in the mechanical department of the Pennsylvania. On October 1, 1922, he was appointed motive-power inspector and on February 15, 1926, was promoted to assistant master mechanic at Wilmington, Del. Mr. Teufel was transferred to Altoona, Pa., on March 1, 1930, and on January 1, 1931, was promoted to master mechanic at New Castle, Pa. On May 1, 1932, he was appointed assistant master mechanic at New York and on November 1, 1933, was advanced to master mechanic at Buffalo, N. Y. Mr. Teufel was later transferred to Pittsburgh, Pa., and Columbus, Ohio.

Master Mechanics and Road Foremen

A. D. HALEY, assistant master mechanic of the Illinois Central at Markham Yard, Chicago, has been promoted to master mechanic at McComb, Miss.

H. T. COVER, master mechanic of the Pennsylvania at Wilmington, Del., has been transferred to Columbus, Ohio, succeeding Walter O. Teufel.

J. L. MARKS, assistant master mechanic of the Pennsylvania at Harrisburg, Pa., has been appointed master mechanic with headquarters at East Altoona, Pa.

C. O. SHULL, master mechanic of the Western Pennsylvania division of the Pennsylvania at Pitcairn, Pa., has been transferred to the position of master mechanic at Wilmington, Del.

B. J. MURTHA, engineman, Philadelphia Terminal division of the Pennsylvania, has been appointed assistant road foreman of engines of the Maryland division, with headquarters at Baltimore, Md.

H. C. WRIGHT, foreman enginehouse and car shops of the Pennsylvania at Grand Rapids, Mich., has been appointed assistant master mechanic of the Philadelphia division, with headquarters at Harrisburg, Pa.

E. R. BUCK, master mechanic of the Pennsylvania at East Altoona, Pa., has been transferred to the position of master mechanic of the Conemaugh and Monongahela divisions, with headquarters at Pittsburgh, Pa.

F. C. GOROM, master mechanic of the Great Western, has been appointed superintendent and master mechanic, with headquarters as before at Loveland, Colo., succeeding C. E. Angove, retired.

Car Department

CHARLES E. RICHARD has been appointed acting foreman, car department, of the Canadian National at Riviere du Loup, Que., succeeding O. St. George, retired.

Shop and Enginehouse

G. R. MILLER, who has been appointed superintendent of shops of the Atchison, Topeka & Santa Fe, at Albuquerque, N. M., as announced in the July issue, was born on April 23, 1887, in Germany. He obtained a common school education and entered the service of the Santa Fe on July 21, 1903, as a machinist apprentice. He became night enginehouse foreman at Winslow, Ariz., on October 29, 1913, and general foreman at Winslow on August 21, 1916. He then served in the United States Army from May 26, 1918, until July 31, 1919. He returned to the Santa Fe on August 23, 1919, as division foreman at Gallup, N. M. On November 23, 1924, he was appointed master mechanic at Slaton, Tex.; on November 1, 1930, master mechanic at Clovis, N. M.; on April 19, 1933, master mechanic at Amarillo, Tex., and on October 20, 1937, master mechanic again at Clovis. He became superintendent of shops at Albuquerque on June 1, 1939.

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers. State the name and number of the bulletin or catalog desired, when mentioned in the description.

LINCOLN LENS.—The Lincoln Electric Company, Cleveland, Ohio. Bulletin No. 359; "Protection of the Eyes for Welding with Lincoln Super-Visibility and High-Visibility Lens."

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THREADING MACHINES.—Landis Machine Company, Waynesboro, Pa. Sixteen-page bulletin, No. H-74-4, descriptive of Landmaco threading machines.

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NATHAN LUBRICATORS.—Nathan Manufacturing Company, 250 Park avenue, New York. Bulletins in loose-leaf form descriptive of various types of Nathan mechanical lubricators.

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OAKITE PRODUCTS.—Oakite Products, Inc., 22 Thames street, New York. 48-page, thirtieth anniversary booklet portraying production cleaning and its related operations in numerous fields, including the railroad industry.

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"NICKEL ALLOYS IN RAILWAY EQUIPMENT."—The International Nickel Company, Inc., 67 Wall street, New York. Twelve-page illustrated booklet descriptive of the properties of nickel steels and other alloys of nickel used in the construction of steam locomotives, freight and passenger cars, and lightweight trains.

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JOURNAL BOXES.—Hyatt Bearings Division, General Motors Sales Corporation, Harrison, N. J. Forty-eight page illustrated catalog descriptive of the Hyatt roller-bearing journal box, the Hyatt railroad roller bearing, and Hyatt journal boxes and bearings, Types J, K, and E.

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PIPE MACHINES.—The Oster Manufacturing Co., Cleveland, Ohio. 2057 East Sixty-First Place, Catalog No. 39-A. Contains time studies, threading speeds, specifications and descriptions of Oster-Williams hand tools and portable pipe machines.

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STANDARD TOOLS.—The Gisholt Machine Company, Madison, Wis. Forty-page catalog, "The Gisholt Standard Tools for Numbers 3, 4 and 5 Ram-Type Universal Turret Lathes," describes an extensive line of tools, including holding devices, boring bars and reamers and shows how they are adapted to a wide range of work on Gisholt Universal high-production and heavy-duty turret lathes.

◆

LOCOMOTIVE EQUIPMENT.—Wilson Engineering Corporation, 122 So. Michigan avenue, Chicago. Sixteen-page Locomotive Equipment Bulletin No. B-1. A general description and part lists of the following products and appliances: Feed-water heater and water conditioner, general service centrifugal pump, heat booster, air compressor radiation, terminal blow-down separator, blow-off mufflers and separators, blow-off cocks and sludge remover. Lists 73 railroads on which all or part of this equipment is now in use.